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RECYCLING TO ART SANATA GERİ DÖNÜŞÜM

2022-1-TR01-KA210-VET-000080998

Türkiye / Karabük 2024

RECYCLING TO ART

(SANATA GERİ DÖNÜŞÜM)

PROJE NO: 2022-1-TR01-KA210-VET-000080998

Yaşama Sevinci Özel Eğitim Meslek Okulu Karabük / Türkiye, Karabuk University - Türkiye, Giovani Per l'Europa - Italy, Special Elementary School "Idnina" - Skopje / The Republic of North Macedonia

Türkiye / Karabük 2024

Recycling to Art

(Sanata Geri Dönüşüm)

Hazırlayanlar

Arif ÖZDEMİR, Şerife EROĞLU YALÇIN, Burcu AYKOL ACAR, Yılmaz OLCAY, Durmuş GÜR, Veysel TOKDEMİR, Ferdinando Comerci, Loreta ANDREEVSKA, Katerina VELICHKOVSKA

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PREFACE

The rapid consumption of seemingly unlimited natural resources by human beings leads to the deterioration of the balance of nature and this situation causes environmental problems and climate change all over the world. While these developments make recycling mandatory, they also show how important it is to prevent environmental pollution and combat climate change. In the scientific book "Zero Waste" prepared by the General Directorate of Environmental Management within the scope of the Ministry of Environment and Urbanization, the importance of waste management is emphasized. As a result of technological developments with the Industrial Revolution, urbanization and population increased, consumption habits and environmental pollution accelerated in direct proportion to living standards. This process has led to the pollution of the world and as a result has resulted in the formation of a lot of waste. The unconscious consumption of natural resources has led to the formation of environmental and climate change problems, which threatens the lives of all living things and has led to air, water and soil pollution problems. Within the framework of sustainable development principles, the goal of zero waste has been developed in order to control the wastes left on land and waters around the world and to leave a clean and developed living space for future generations. Within the scope of this purpose, awareness has been created regarding the management of waste in nature in the targets that determined by the General Directorate of Environmental Management. The gradual decrease in seemingly unlimited natural resources, which have an important place in our lives, environmental pollution caused by waste produced, has caused climate change with global warming, and various health problems. Such negative developments increase the importance of recycling practices even more. The concept of recycling aims both to contribute to the economy and to prevent the negative process of environmental pollution and climate change.

In general, reintroducing waste to nature aims to partially prevent the ongoing negativity. In direct proportion to the increasing population and developing industrialization, there are many products such as plastic, paper, glass, metal and fabric etc. among the wastes that take up a lot of space in nature. Recycling solid wastes such as metal, glass, plastic, paper and textile, which are recycled by heavy industry and small-scale individual productions,

back to the economy and art through handicrafts has achieved its purpose with our project called "Recycling to Art" and has gained awareness with our work. It was thought that our work called "Recycling to Art" would make an important contribution to the fight against the environment and climate change, and an EU project was initiated in cooperation with Karabük University Safranbolu Şefik Yılmaz Dizdar Vocational School and Karabük Yaşama Sevinci Special Training Vocational School.

It has aimed to prevent the unconscious and rapid consumption of natural resources in the Ministry of Science, Industry and Technology's National Recycling Strategy Document and Action Plan between 2014-2017. In addition, with the aim of preventing waste in nature from causing environmental problems, it was acted with the idea of eliminating chemical wastes that threaten human health. Waste management, which aims to transform waste into economic input and value, has enabled the development of various strategies for this purpose. In the Recycling Strategy Document and Action Plan prepared by the Ministry of Science, Industry and Technology, it is stated that more than half of the waste in Turkey is suitable for recycling. It is also stated in this action plan that the recycling strategy will provide advantages in areas such as creating new employment in our country, effective use of natural resources, economic benefits and improving the environment. The project we have completed shows that recycling of waste materials has a very wide range of applications and that it is possible to bring functional, useful and many new products to life. The fact that the target group of our project includes disadvantaged students at the application level has made our project even more special. The fact that our disadvantaged target group students create economic and functional products using recycling and handicraft methods from waste materials shows that the practices appeal to all levels of people. The fact that wastes consisting of various groups of materials can be obtained almost free of charge in our daily lives makes the economic return of handicraft works with recycled materials even easier. With the training modules offered within the scope of the project called Recycling to Art, it was aimed to improve the handicraft skills of disadvantaged students, to enable them to take part in economic life, to raise awareness in their education level, to provide information about the environment and climate change to the target group students and our goals have been achieved. Students' professional competencies in traditional handicrafts, which are

popular and remarkable today and which also improve their handicrafts, have been tested and success has been achieved with the practices. Support has been received from experts and competent scientists in this field for the target audience of the project. In this context, joint studies have been carried out with a staff of scientists who are professional on an international level and have competence in complementary disciplines. In the workshops held in educational institutions in Turkey, Italy and Macedonia, various handicraft applications were determined from solid waste; souvenirs, toys, household items, ornaments and various works of art have been produced. New and functional recycling materials created from waste materials using handicraft methods with students have been documented with videos and photographs to be used for educational purposes later. At this stage, the translation and presentations of Dr. Yılmaz OLCAY and Asst. Prof Durmuş GÜR's translations and presentations are of great importance.

Within the scope of the project, the handicraft skills of mildly levels disadvantaged students studying in the field of vocational education have been developed, and has been provided awareness about the fight against the environment and climate change, with increasing their motivation through artistic activities implemented. Erasmus+ KA210 project experience has been gained to the institutions in the project carried out through inter-institutional interaction and cooperation at international level. Thus, the concrete outputs obtained within the scope of the project addressed the needs of the participating institutions and target groups. In the event named Sanata Geri Dönüşüm / Recycling to Art with the number 2022-1-TR01-KA210-VET-000080998, which was successfully completed by our school, which hosted trainings during the project process, scientists getting involved from GIOVANI PER L'EUROPA Nicotera / Italy, Special Elementary school "Idnina" - Skopje / North Macedonia and Karabük University Safranbolu Şefik Yılmaz Dizdar Vocational School achieved successful applications. It is among our wishes that the successfully completed project should be a stepping stone to new and original studies in the future.

Karabük, 2024

Project Coordinator and Educational Institution

Arif Özdemir

Yaşama Sevinci Special Training Vocational School

THANKS

The European Union project titled Sanata Geri Dönüşüm / Recycling to Art with the number 2022-1-TR01-KA210-VET-000080998 of Karabük Sevinci Vocational School for Special Education, which was the coordinating institution in the project, which had a successful training process, has been completed in 18 months. Within the scope of the project, an economic value was obtained again by recycling waste materials and using handicraft methods; a three-stage training system was implemented with the aim of creating functional and useful new products. We are grateful to Mr. Nevzat AKBAŞ, Provincial Director of National Education of Karabük, for his support and assistance to the project. Moreover, We cannot thank Karabük Provincial Directorate of National Education R&D Unit Branch Manager Adnan CANSIZ enough that in response to his initiatives that showed that he was with us at every stage, especially his support in the last months of 2022, when the project started to sprout. Two scientists from Karabük University worked within the scope of the project. We would like to express our gratitude to Yılmaz OLCAY, who works at Karabük University Technology Transfer Office and is also a PhD student, and Asst. Prof. Durmuş GÜR, Head of the Handicrafts Department at Karabük University Safranbolu Şefik Yılmaz Dizdar Vocational School, for providing expert advice on traditional handicrafts during the trainings in the laboratories in Italy, North Macedonia and Turkey, and for supporting our communication with our foreign partners through translation.

A professional cooperation with international participants has been realized. We would like to thank our project partners from experts in traditional crafts of the educational association GIOVANI PER L'EUROPA (Nicotera / Italy) Ferdinando COMERCI, Rombola FERDINANDO, Zungri CRISTINA and Antonio MELOGRANO, for their cooperation and support during the project. We are grateful for their positive contribution to the project and for sharing knowledge and experience. Additionally, we would like to express our admiration to Loreta ANDREEVSKA, principal of Special Elementary school "Idnina" (Skopje / North Macedonia), another of our international level project partners, and special education teacher Katerina VELICHKOVSKA, for sharing their valuable knowledge and experience with us.

Finally, I would like to express my gratitude and gratitude to the school principal Yurdaer UYSAL, Handicrafts Teacher Şerife EROĞLU YALÇIN, and Food Technology Teacher Burcu AYKOL ACAR who are members of the project team in our school hosted in Turkey by Karabük Yaşama Sevinci Special Training Vocational School, for their extraordinarily determined and enthusiastic work in carrying out the project and for the scientific support they provided to the project. In addition to serving as the coordinator of such a comprehensive and successfully completed international project, I would like to express my gratitude to take part in this successful training process with the interdisciplinary project partners in Italy, North Macedonia and Turkey, and express my respects to all institutions and organizations that supported the project.

Karabük, 2024
Project Coordinator and Educational Institution
Arif Özdemir
Yaşama Sevinci Special Training Vocational School

OUTHERS CV

Arif ÖZDEMİR
Yaşama Sevinci Special Education Vocational High School / Karabük / Türkiye
E-mail: arse7678@hotmail.com

I work as a Guidance Teacher at Yaşam Sevinci Special Education Vocational High School, a public school in Karabük. I was born in 1976 in Dörtyol district of Hatay. I completed my primary, secondary and high school education in the schools in Dörtyol district of Hatay (Gazi primary school, Gazi Secondary School and Atatürk High School). I completed my university education in 2001 at Ankara Gazi University, Gazi Faculty of Education, Department of Educational Sciences. I completed my master's degree at Karabük University, Postgraduate Education Institute, Department of Public Administration in 2022. I worked as a project coordinator in the "We are in European Cuisine" Erasmus+ project in Barcelona/Spain with the project number 2018-1-TR01-KA102-049858. I am currently working as a coordinator in the "Recycling to Art" project with project number 2022-1-TR01-KA210-VET-000080998. I am married and I have a child.

Burcu AYKOL ACAR (Teacher)
Milli Eğitim Bakanlığı Karabük Yaşama Sevinci Özel Eğitim Meslek Okulu Gıda Teknolojisi Öğretmeni ve Bölüm Şefi, Karabük, Türkiye.
E-mail: burcuaykolacar@gmail.com

Burcu AYKOL ACAR, was born in 1984 in Safranbolu/Karabük. After finishing Safranbolu Anatolian High School in 2002, she graduated from Uludağ University Food Engineering Programme in 2008. She worked for 6 years as a food engineer in catering industry. In 2014, she got her Pedagogical Formation at Ankara University Faculty of Education for teaching certificate. She was appointed as a Food Technology Teacher at Beylikova Multi Programme Anatolian High School at Ministry of Education in 2014 in Beylikova, Eskişehir. She is working as a Food Technology Teacher and section chef at Yaşam Sevinci Special Education Vocational High School in

Karabük. At the same time, she is continueing her master degree in Faculty of Management at Karabük University. She took part in the project called " We are in European Cuisine" on Turkey National Agency Erasmus+ with project number "2018-1-TR01-KA102-049858". She also participated in the project called "Recycling to Art" on Turkey National Agency Erasmus+ with project number "2022-1-TR01-KA210-VET-000080998".

Durmuş GÜR (Asst. Prof.)
Karabuk University, Safranbolu Şefik Yilmaz Dizdar Vocational School, Traditional Handicraft Pro. Faculty Member / Assistant Professor, Safranbolu / Karabük, Turkey.
E-mail: durmusgur@gmail.com **Orcid ID:** 0000-0002-9945-8825
Durmuş GÜR was born in 1989 in Türkeli/Sinop. He was the first to graduate from the Art History Department of Trakya University in 2011. He completed his master's degree at the Art History Department of Hacettepe University between 2013-2015. Then he received his Ph.D. in Byzantine Art at Hacettepe University, Institute of Social Sciences in 2019. He is still working as a faculty member in Karabuk University, Safranbolu Şefik Yilmaz Dizdar Vocational School, Traditional Handicraft Pro. He also teaches undergraduate courses and works as a historian or researcher in scientific projects. He is the author of four books and numerous articles and papers in fields as diverse as Art History, architecture, Christianity, iconography and painting.

Ferdinando Comerci
Giovani per l'Europa, registro n. 50 delle Persone Giuridiche della Regione Calabria, Italy, Nicotera
E-mail: comercif@yahoo.it
Dates From 2006 to Today Employer Giovani per l'Europa Type of business Non-profit Organization Occupation President / Employee Main activities Write projects, monitoring and mentoring programs for training, Relationship management between the foreign companies and the scholarship beneficiaries; relations with European partners; • Dates from March 2008 to May 2008 Name and address of employer Technical Institute, Russian Achilles Vibo Valentia Nicotera • Type of business or sector Public School • Occupation External expert • Main activities and responsibilities Foreign

Expert in economic and legal in the project F2 PON Date April 2005 to November 2006 Employer Gold Travel Type of business Tour Operator Employment Type Employee (co.co.co.) Main activities Responsible socio-cultural exchanges. Doing business with the facilities. Dates November 2002 to February 2006 Employer Studio Associate Chartered Accountants Ferrara & Schiariti Company Type Commercial Studies Employment type Internship Main activities Accounting ordinary to the preparation of the budget, data processing, simplified accounting, company constitutions, liquidations VAT, compilations Form F24, 730, 740, Subscriptions REC, Chamber of Commerce

Katerina VELICHKOVSKA (Teacher, Special Educator and Rehabilitator)
Primary school with resource center "Idnina"-Skopje, North Macedonia
E-mail: kate_veli@hotmail.com

Special educator and rehabilitator with 12 years of experience. 7 years working in elementary school with resource center "Idnina"-Skopje. Cooperation with comunity and regular elementary schools Preparation of annual, thematic planning, Preparation of individual planning, Organization and realization of teaching hours in new methdos (flipped classroom, sensory stimulation and integrations, Montessori pedagogy, art therapy), Monitoring and assessment of the achievements of students, Organization and realization of free activities, Working with parents, Profesional development and cooperation Analytical research,School structure and organization. President of Association for education and rehabilitation InterKid-Skopje. Member of the Association of Special Educators and Rehabilitators of the Republic of North Macedonia from 2009, Member of the Presidency of the Association of Special Educators and Rehabilitators of the Republic of Macedonia from 2011. Participation in a large number of trainings and international expert meetings for which I have appropriate certificates.

Loreta ANDREEVSKA (Teacher, Special Educator and Rehabilitator)
Primary school with resource center "Idnina"-Skopje, North Macedonia
E-mail: lpandreevska@yahoo.com

Special educator and rehabilitator with 27 years of experience. 5 years working as director in elementary school with resource center “Idnina”-Skopje. She is responsible for the legality of the work and for the material and financial schoolwork. Her knowledge, skills, and professional values in the areas of Leadership; Human Resource Management; Pedagogical management of the school; Financial management and Lawful and administrative operation of the school helps the activities in the institution. Member of the Association of Special Educators and Rehabilitators of the Republic of North Macedonia from 2009. Participation in a large number of trainings and international expert meetings for which I have appropriate certificates.

Şerife EROĞLU YALÇIN (Teacher)
Ministry of Education Karabük Yaşama Sevinci Special Education Vocational School, Handicraft Technology Teacher and Head of the Department, Karabük, Türkiye.
E-mail: serifeerogluyalcin@gmail.com
She was born in Ankara in 1982, graduated from Yenimahalle Girls Vocational High School, Embroidery department in 1999, and graduated from Gazi University, Faculty of Vocational Education, Decorative Arts Teaching in 2008. He worked as a master teacher at Karabük Public Education Center for 7 years between 2008 and 2015. In 2016 she started to work at MEB. After working as a Crafts teacher at Eskipazar Multi-Program Anatolian High School and Eskipazar Public Education Center in Eskipazar district of Karabük Province for a total of 6 years, he continues to work as a Crafts Technology teacher and department head at Karabük Central Joy of Life Special Education Vocational School. In addition, he completed his Master's Degree without Thesis in the Department of Entrepreneurship at Karabuk University in 2023.

Veysel TOKDEMİR (Asst. Prof.)
Karabük University, Safranbolu Şefik Yilmaz Dizdar Vocational School, Interior Design Pro. Faculty Member / Assistant Professor, Safranbolu / Karabük, Turkey.

E-mail:veyseltokdemir@karabuk.edu.tr, **Orcid ID:**0000-0001-9744-9979
Veysel TOKDEMİR was born in Afyonkarahisar, where he completed his primary, secondary and high school education. He received his university education at Kütahya Dumlupınar University and graduated from the Furniture and Decoration Teaching Programme in 2006. He completed his Master's degree at Karabük University, Department of Furniture and Decoration and his PhD at Karabük University, Department of Forest Industry Engineering. In 2010, he started his academic life as a lecturer at Karabük University Safranbolu Şefik Yılmaz Dizdar Vocational High School Interior Design Programme.

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CHAPTER 1

Recycling of Plastic Waste Within the Framework of Recycling to Art Re-Evaluation

Durmuş GÜR
Asst. Prof. Durmuş GÜR, Karabük University, Safranbolu SYD. Vocational School, Department of Handicrafts, Head of Department, Karabük, Turkey.
durmusgur@gmail.com
Orcid ID: 0000-0002-9945-8825

Veysel TOKDEMİR
Asst. Prof. Veysel TOKDEMİR, Karabük University, Safranbolu ŞYD. Vocational School, Safranbolu Şefik Yılmaz Dizdar Vocational School of Design Interior Design Pro., Karabük, Turkey.
veyseltokdemir@karabuk.edu.tr
Orcid ID: 0000-0001-9744-9979

INTRODUCTION

The modern age has brought many new materials into our lives, and many of these materials have become indispensable elements of our lives. Plastic materials have the biggest place among them. Plastic has a very wide range in the production of industrial objects. Synthetic or semi-synthetic, organic, deformable solid materials are called plastics. It is also possible to increase their performance or reduce their cost with certain additives. Many different types of plastics have been developed according to the properties required by technology and industry. Easily moulded plastics are lightweight and durable. Plastics with the ability to insulate against electrical current, heat and cold are resistant to many chemicals. Due to their reusable and recyclable properties, plastics have a wide range of applications in many products today (Purde, 2009: 33; Düzakın, 2021: 75).

Plastics, which have the highest use in the world, are used in transport vehicles, white goods, medical and technological equipment, liquid containers, the construction sector, the packaging sector and many other sectors (Purde, 2009: 35; Düzakın, 2021: 76). In recent years, an average of 400 million tonnes of plastic materials, the use of which has increased even more in recent years, consists of waste materials. On average, 80% of this plastic waste is generated on land and 20% in water. Plastic waste, which takes up a lot of space every year, should be recycled as soon as possible. Otherwise, it is predicted that plastics, which currently occupy some of our living space, will occupy a very large space in the future.

Plastics can be divided into two main groups according to their interaction with heat: thermosets (those that harden when heat is applied) and thermoplastics (those that soften when heat is applied). Their interaction properties with heat affect the recycling of plastics. The recycling potential of thermoplastics is higher than that of thermosets (Düzakın, 2021: 75). The micron values as well as the materials used in the production of plastics make it difficult to dissolve in nature (Fig. 1).

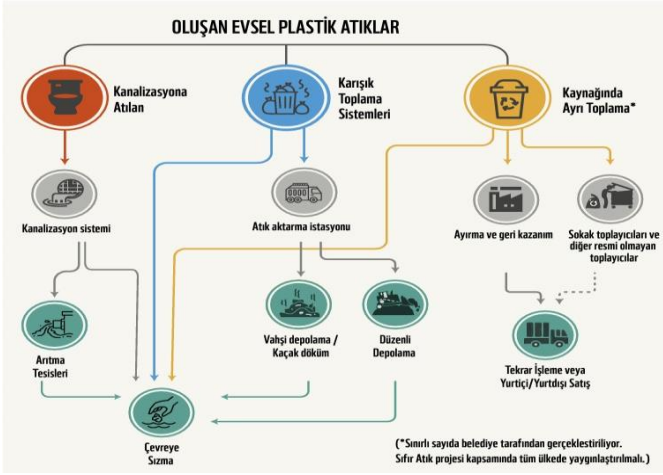


Figure 1. Formation Phase of Plastic Waste (Onay et al., 2021: 21)

The idea that the widespread use of plastics can be a solution to environmental problems has led to the widespread use of bioplastics (Düzakın, 2021: 73). The recycling of plastics and the widespread use of bioplastics have partially prevented environmental pollution. Plastic recycling is carried out with the help of human hands and machines. Mechanical recycling physically processes plastic waste and makes it reusable. Recycling by incineration is a method that should never be accepted. The majority of polymeric materials are hydrocarbon in structure and as a result of their combustion, carbon dioxide (CO2) and water (H2O) are produced. Uncontrolled burning of polymers also produces carbon monoxide (CO). However, the products resulting from the combustion of plastics are not limited to these and various by-products are formed depending on the type of plastic and additives (Anonymous, 2021: 8).

Plastic waste directly or indirectly affects the entire ecosystem (sea, lake, land, river, ocean). Plastics are made from various petrochemicals (fossil fuels such as natural gas or petrol). Therefore, these products affect the entire ecosystem as microplastics and macroplastics (plastic pieces less than 5 millimetres in diameter) and take a very long time to be recycled in the natural environment (Yakışık, 2023: 37).

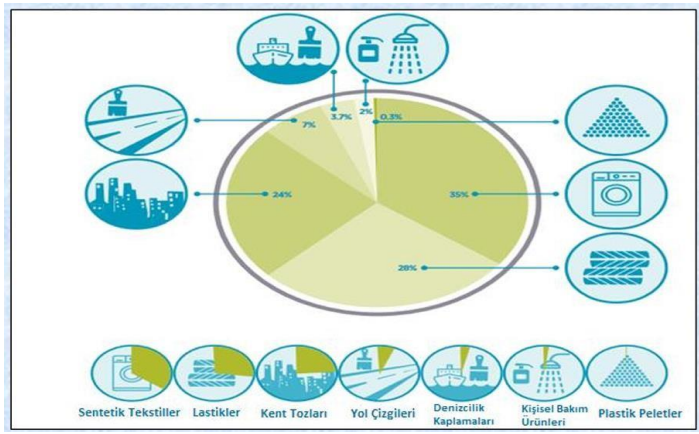


Figure 2. Sources of Microplastics in the Oceans (Anonymous, 2021: 9)

The breakdown of plastic into small pieces as it dissolves in nature causes the proliferation of microplastics, which pose a great threat to all living things in nature, especially humans. The fact that plastic particles have been found in glaciers and even microplastics have been found in the Mariana Trench, the deepest known point in the world, is evidence that these plastic wastes have been polluting the environment and ecosystem uncontrollably for years (Yurtsever, 2018: 171; Düzakın, 2021: 78). Especially in Turkey, microplastics have been detected in beaches, sediments, seawater, seabed and lakes. Microplastics have been found in various organisms living in the sea, and microplastics, especially in fish and shellfish, pose a risk by being transferred to the organisms that consume them. 344 species worldwide and 134 species in the Mediterranean are threatened by plastic debris. In the Mediterranean, microplastics have been found in everything from whales to fish, seabirds, turtles and even microscopic zooplankton. This situation also poses a threat to humans who consume shellfish and fish (Onay et al., 2021: 21). If action is not taken as soon as possible, it will be an irreversible process for all living things and nature (Fig. 2).

Since 1950, the production of plastics has increased in line with population growth. The flexible and durable structure of plastics is very effective in the strong preference of plastics in packaging products. Therefore, the fact that plastics, which are often preferred, take up a lot of space as waste materials in nature shows that it is not a very innocent material

(Yakışık, 2023: 37). Considering various factors such as technological development, acceleration of trade, increase in production and population growth, it has been revealed that micro and macro plastic waste permanently affects the health of the natural environment, especially the health of living beings on earth, causes global warming and even accelerates climate change (Yakışık, 2023: 37).

While the world struggled with climate change and the decline of biodiversity until the 1970s, it began to struggle with plastic waste pollution after the 1990s (Hanbay, 2020: 101-105; Yakışık, 2023: 42). Plastic waste not only causes aesthetic pollution in nature, but also breaks down into smaller particles and becomes more harmful to the environment and living organisms for many years (Yurtsever, 2018: 171). It is stated that waste that endangers the integrity of the ecosystem makes it 80% more difficult to achieve sustainable development goals, especially in the areas of food, health, poverty, hunger, health, water, cities and climate (Hanbay, 2020: 101-105; Yakışık, 2023: 42).

As consumption in industrialised societies has increased, so has the production of waste. As a result of the damage caused to nature by this waste in the world, various initiatives have been taken to recycle it. If we do not find solutions to the pollution that is increasing its effects every day, the pollution will affect the whole world, the atmosphere will change and diseases will increase (Yücel, 2020: 35). In this field, measures should be taken especially against plastic waste and it should be recycled.

Plastic waste, which causes pollution in nature, has been reprocessed and recycled with the developing technology. In 2004, China alone accounted for 45.1% of plastic waste imports, which have been increasing since the 1990s (Yakışık, 2023: 37).

Applications of Recycled Plastics and Their Use in the Art Environment

Plastics found as waste in nature are mostly used in everyday items and basic necessities. It is possible to obtain very rich applications from waste plastic products. Greenhouse roofing, automotive sector, spare parts used in daily life, plastic bags, sewer pipes, detergent bottles, garbage cans, marley and various plastic filling materials, toys, coatings, textile sector and ornaments are produced in a wide range. In addition, plastic waste reprocessed by artists has been presented to people's taste as art products (Anonymous, 2006; İsgilip, 2014; Johnson, 2019: 11-12, Fig. 2-9; Johnson,

2019; Düzakın, 2021: 73-92; Hanbay, 2021: 101-131; Armağan-Benek, 2023: 11-20).

It is known that recycled plastics are used in the field of art as well as for various purposes. The bond between man and nature has started to break over time and environmental problems have emerged since this process (Yücel, 2020: 31). As the actual preliminary structure of sculpture, which is formed on the axis of artist, artwork and recipient (subject) and communicates with the public differently than other plastic arts with its material type structure and properties, material preference is extremely important. For this reason, the use of waste materials is not only related to the use of waste, but also offers an opportunity to push the limits of creativity in waste materials. Artists can create unique and impressive works by using extraordinary materials (Tilki, 2024: 376). Under these conditions, plastic waste, like many waste materials in nature, is extremely important in terms of recycled artworks. In the modern period, many works have been produced with the concept of recycling art. In particular, the works of art made with plastic waste are extremely important in raising awareness about the negativities in nature (Armağan-Benek, 2023: 16).

Plastic waste has started to be reused or recycled for production purposes in many areas. One of these applications is art. The art object, which is a reflection of the artist's inner world, gains a new reality with different materials. At this stage, artists who also use plastic waste have created new works of art. With the uniqueness of art, the artist redesigns the waste object that has become garbage and presents it to the public as an art object. The re-evaluation of these objects through art under the name of recycling has created an awareness through the waste object. Moreover, the waste object has also played a role in the emergence of important works that we call masterpieces in the history of art (Öznülüer, 2019: 707).

Picasso and Braque performed the collage-collage technique by placing the materials themselves on the surface. In this technique, the use of materials created a texture on the surface of the canvas, which broke the superficiality and created the effect of three-dimensionality. At this stage, artists used waste objects as materials other than art materials, completely eliminating the search for the perfect beauty of painting and directing new searches and experiments (İsgilip, 2014: 61; Öznülüer, 2019: 703). At this stage, plastic waste has found its place in various branches of art such as

painting and sculpture. Modern artists have also contributed to the development of the concept of recycling in art through plastic waste, by producing their works in new searches.

Since the 1960s, recycling products have attracted the attention of artists and many artworks have been produced to raise awareness. Various modern works of art have been made from plastics, which are the most difficult of the waste materials to recycle and cause environmental problems. In the 21st century, these applications, which are among the important works of artists, include sculptures, paintings and various works of art (Yücel, 2020: 31). Most artists, as historians and researchers, have made artistic productions by arranging plastic objects such as plastic bags, toys, toothpaste, car wheels, plastic bottles, scrap goods, clothes, car parts, etc. (Toluyağ, 2021: 187).

In the 1970s, the artist Tony Cragg sorted the plastic waste he collected according to size and colour and created an artistic environment by placing the colourful silhouettes he made from them on the floor and walls (Toluyağ, 2021: 187). In recent years, many works of art have been created with plastics from land and water in order to raise awareness (Yücel, 2020: 35).

Artist Veronika Richterová has made dozens of sculptures from plastic bottles, turning rubbish into art. Richterová also has a Museum of Plastic Bottle Art, where she displays her collection of different types of bottles from many countries. The artist, who has been making sculptures from recycled plastic bottles since 2004, began her work, which she calls "Pet-Art" (Plastic Bottle Art), after seeing the deformation of plastic bottles with heat. The artist, who has made hundreds of sculptures from thousands of plastic bottles since 2004, has raised enough awareness by developing methods related to the technological processes of this work (Fig. 3).[1]

[1]https://www.arkitera.com/haber/plastik-siselerin-sanat-yoluyla-geri-donusumu/ 10.06.2023, 14:48

Figure 3. Left: Veronika Richterová, Mushrooms, 2005 (Fig. Michal Cihlár), Right: Veronika Richterová, Roses, 2007 (Fig. Michal Cihlár) [2]

Pascale Marthine Tayou's sculpture Africonda, created in 2014, looks attractive, innocent and cute, but it actually symbolises a world full of people who pretend to avoid real contact with each other. In the end, we see the snake biting its own tail. One of the biggest factors in the damage done to nature by the increasing mechanisation and industrialisation of the world, and the shortening of nature's lifespan, is the widespread use of plastic bags. This installation of colourful plastic bags expresses the damage caused by humans to their natural environment and the way they disrespect nature (Toluyağ, 2021: 193-194, fig. 11).

For Tadashi Kawamata's installation at the Lisbon Museum of Art, Architecture and Technology in 2018, 400 volunteer participants of six different nationalities collected around 450 tonnes of garbage from the coast in and around Portugal over a period of 16 years. The plastics on the upper level of the work are arranged in such a way that the underwater world is not visible. In the lower part of the work, the effect is of sunlight filtering through the piles of plastic at the top. The viewer feels as if they are walking under the sea. With this work, which was created by recycling plastic waste, the artist raised awareness of environmental pollution, a global problem (Toluyağ, 2021: 194, fig. 12).

[2]https://www.arkitera.com/haber/plastik-siselerin-sanat-yoluyla-geri-donusumu/ 10.06.2023, 14:48

In 2019, an architecture called New Wave was created in Mexico using plastic bottles collected from the ocean. Woo Kwang Jin is the leader of the gigantic form created with waste materials (Yücel, 2020: 35). In GBO, a Korean design company, the work called Plastic Catcher created by Woo Kwang Jin decorates a large square (Yücel, 2020: 36) (Fig. 4).

Figure 4. Woo Kwang Jin, Plastic Catcher (Yücel, 2020: 36)

Rox De Luca was exhibited in 2020 by making sculptures out of plastic bottles, bottle caps and straws on the beaches of Sydney. The wreaths created by the artist were named 'Gleaning for plastics, defying wastefulness' to raise awareness (Armağan-Benek, 2023: 16). Apart from such practices, many private and public organisations have incorporated recyclable plastic art applications. In particular, some municipalities have preferred to recycle waste by making new products or various art installations from the collected recyclable waste (Onay et al., 2021: 33).

Creating aesthetically pleasing art is a great way to quickly impress viewers. To create something aesthetically pleasing, some artists have used plastic waste as their main material. International artists such as Dianna Cohen, Alison McDonald and Chris Jordan are examples of this. Dianna Cohen has managed to attract the attention of the audience by using the bright colours of plastic waste bags in most of her works (Johnson, 2019: 10-11).

Alison McDonald has organised a permanent exhibition of plastic bottles at the Monterey Bay Aquarium. Her delicate cuts on plastic bottles use both positive and negative space in a calm yet sombre way. In addition to the exhibition of cut plastic bottles, the artist's work is composed of plastic bottle caps connected by cables. From a distance it looks like a beautiful blanket for the rocks on the beach. The applications also demonstrate McDonald's skilful

use of small materials to create a much larger new form (Johnson, 2019: 11-12, fig. 2-9) (Fig. 5).

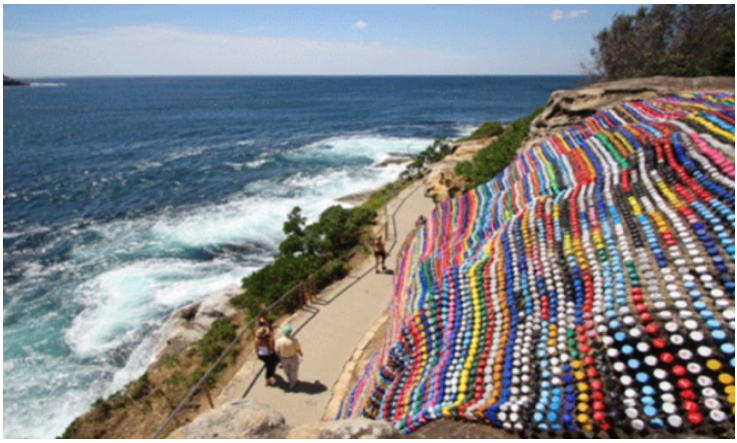


Figure 5. McDonald, Alison, Flow (2013)
(Johnson, 2019: 12, Fig. 2-9)

Plastic waste has been used in some artworks with its natural methods, reshaped, painted or transformed back into art with the waste casting technique (Yücel, 2020; Tilki, 2024: 376-380). At this stage, plastic waste is also being used as filaments in three-dimensional printers to transform them into art. The filaments can be produced from original plastics as well as from filaments obtained by recycling plastic waste in nature. As part of the study, an application was made using the recycled plastic filaments we obtained.

Printing Plastic Products With Recycled PET Filament

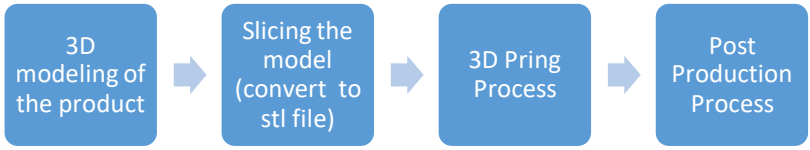
Plastic bottles found as waste in nature were collected and sorted by colour and type of plastic. The classified plastic bottles of the same colour and type were cleaned from labels and other waste. The cleaned and dried plastic bottles were flattened with pressure and temperature to remove the wrinkles on the plastic bottles and converted into 1.75 mm filament with the help of a handmade extruder. White coloured 1.75±0.2 mm diameter filament made from recycled PET bottles was preferred for printing. An Xperia model FDM (fused deposition modelling) printer was used for printing.

Xperia 3D Printer technical information is as follows;

-X:320 mm Y:240 mm Z:280 mm can work in a wide printing area.

-0.9 degree stepper motors with high-resolution Core XY system are fast, rigid and quiet. Excellent precision is provided in X and Y axes with miniature series slide rail bearing system in your professional work.
-Z axis has precise motion transmission system with ball screw and ball nut.
-Made of stainless metal, cut with industrial precision laser machines.
-1.75mm thick ABS, PLA, Flex, PVA, etc. Suitable for filaments up to 280ºC degree temperature. It can print with 50 micron precision with.
-0.1 nozzle. -It has the ability to pick up where it left off with the filament end sensor.
-It has extruder connection suitable for laser, drill and special purpose use.
-It has autolevel automatic calibration system with capacitive autonics sensor.
-128x64 full graphic LCD screen.
-With the SD card, you can operate the machine independently or connected to the computer The product you are printing will make small movements, allowing more precise printing.

-The printing project is carried out in the following stages.



Filament obtained from recycled white coloured PET bottles with a diameter of 1.75±0.2 mm was used for printing. The printing process of the waste plastic filament was carried out according to the following parameters.

Printing Temperature	210 °C
Nozzle Diameter	0.3 mm
Infill Geometry	Rectilinear
Infill Rate	%100
Layer Height	0.2 mm
Number of Perimeter	2
Print Speed	2400 mm/min
Print Time	3 hours 41 min

In addition to the artworks created by artists, Julius Caesar's pen holder, which has a 3D design using filaments previously recovered from plastic waste, was printed in 3 hours and 41 minutes

(http://www.thingiverse.com/thing:2536988). Through the recycling of plastic waste and the use of 3D printing technology, the model of Julius Caesar was redesigned and given function as a pen holder. This work is significant in terms of sustainability and innovation, offering a creative combination of history and modern technology (Fig. 6-7).

Figure 6-7. Julius Caesar Modelled Pen Holder Printed From Waste PET Bottles (2024)

A European Union project (No: 2022-1-TR01-KA210-VET-000080998) was carried out in December 2022 in cooperation with Italy, Northern Macedonia and Turkey to bring the works of art made with plastic waste by valuable artists from different countries into the field of education and to raise awareness. In the project, the issue of bringing plastic waste into art has attracted a lot of attention and practices have been carried out in three countries for this purpose. The project, which started in 2022 and lasted for 13 months, was called "Recycling to Art". Scientists from Karabük University, Giovani Per l'Europa (Italy) and Special Primary School "Idnina" - Skopje (Republic of North Macedonia) took part in the project based in Turkey. While many waste materials are recycled through Recycling to Art, works of art and ornaments made from plastic products play a major role in the applications.

Within the framework of recycling plastics into art, various artistic activities were carried out with the participation of scientists from important schools such as Giovani Per l'Europa (Italy) and Special Elementary School "Idnina" - Skopje (Republic of North Macedonia). Plastic casts of some works of art were made by making filaments from pieces of plastic containers. The pencil-shaped bust of Julius Caesar is an example of this. In addition, some plastic parts were combined and products such as frames,

pencil holders, lampshades, flower pots, coffee tables, tables, etc. were created to support the zero waste scope. Training was provided by making products in this area and awareness was raised among students and teachers (Fig. 8-9).

Figure 8-9. Workshops on Recycling Plastics into Art (2024)

EVALUATION AND CONCLUSION

Plastic waste endangers nature and all living things more and more every day. Awareness should be raised by giving more space to projects developed by the private sector and municipalities for the separate collection and recycling of plastics (Onay et al., 2021: 13).

The concept of zero waste, which was developed in order to never use plastic waste, has had an impact around the world. As defined by the Zero Waste International Alliance, *"Zero waste is the protection of all resources through the responsible production, consumption, reuse and recovery of products (plastics and other wastes) that threaten the environment or human health, without discharge to land, water or air, or incineration".* According to the Zero Waste theme, waste should be separated in cities, workplaces and homes. Local governments in cities have great responsibilities in this regard. Measures should be taken to stop the use of plastic through restrictions and bans, and measures should be taken to manage plastic waste through alternative methods. For example, measures have been taken by banning the use of plastic bags in EU countries such as Austria, Belgium, France, Italy, Poland, Portugal and Romania, and the use of plastic bags has been taxed or

charged in various countries such as Bulgaria, the Czech Republic, Denmark, Cyprus, Croatia, the Netherlands, Spain, Ireland, Sweden, Latvia, Lithuania, Luxembourg, Hungary, Malta, Slovakia, Slovenia, Greece, the United Kingdom and Turkey (Anonymous, 2021: 12-13).

Recycling targets have been set in the Waste Framework Directive, and the 2018/851 revision aims to further reduce waste generation. By 2025, 55 per cent of municipal waste should be generated and collected for recycling or recovery, by 2030, 60 per cent and by 2035, 65 per cent. Within this framework, EU Member States have set targets for the programmed prevention or reduction of waste generation, the re-use of waste through methods such as reuse, recycling and recovery, the necessary arrangements for the separate collection of recyclable waste (paper, metal, plastic, glass), the necessary measures to promote recycling and recovery, and ensuring that Extended Producer Responsibility (EPR) schemes operate easily and with minimum operating costs (Onay et al., 2021: 26). In line with these objectives, plastics should be collected, sorted, milled and returned to the industrial sector as raw materials and semi-finished products. These wastes should be reused in the production of plastic-based products or semi-finished products in industrial enterprises in the domestic and foreign markets. At this stage, large industrial machines or individual small machines are used. A plastic recycling machine is a plastic processing machine that works with an extrusion system to convert plastic waste materials into raw materials suitable for re-production (Anonymous, 2006: 3-11, Fig. 1.1).

Plastic recycling bins should be provided to private public institutions and organisations, recycling bins should be placed in streets, avenues and squares, the subject should be taught as a course in schools, public awareness should be raised through seminars, awareness should be raised through conferences, articles and other scientific publications. Joint projects should be carried out with local and foreign partners, workshops should be organised and participants should contribute to the creation of new products from recycled materials.

In conclusion, we should bring the accumulation of objects and the pollution caused by plastic waste, which affects the whole world, back into art through artists. In this article, the recycling of plastic waste is evaluated and analysed through sample works in the context of recycling waste into art.

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CHAPTER 2

An Efficient Solution for Clothing Waste Management: Upcycling Clothing Waste Through Traditional Handicrafts

Author:

Yılmaz OLCAY

PhD Student, Karabük University Industrial Engineering

yilmazolcay@karabuk.edu.tr

An Efficient Solution in the Circular Economy: **Upcycling Textile Waste Through Traditional Handicrafts**

The Project of "Recycling to Art" which carried out with international partnership included Italy, Macedonia and Türkiye, is an important Erasmus+ KA210-VET project in terms of environmental, social and circular economy. The priorities of the project are as follows:

HORIZONTAL: Environment and fight against climate change.

VET: Contributing to innovation in vocational education and training.

VET: Improving quality assurance in vocational education and training.

Figure 1. The first meeting in Nicotera/Italy (24th of May, 2023)

Besides, we believe that this project may contribute to 5 Sustainable Development Goals of UN such as Goal 6: Clean water and Sanitation, Goal

7: Affordable and Clean Energy, Goal 13: Climate Action [1], Goal 1: No Poverty and Goal 5: Gender Equality.

We focused on upcycling of the wastes such as glass, paper, plastic, metal and textile wastes through traditional handicraft in this project. In this chapter we present upcycling of textile wastes and handicraft products.

The textile sector is one of the most polluting [2] and waste generating sector [3]. Greenhouse gas emissions which caused by textile sector was 1.2 billion tonnes CO_2-eq in 2015 and textile production amount have doubled over the past 15 years [4]. With increasing the amount of textile production, the textile waste increased, too [5]. It was 12.6 million tonnes in 2019 year [6] and it has been estimated that the total textile waste will be 148 million tonnes by 2030 [7].

Figure 2. Clothing Waste [8]

Recycling of textile waste is an issue which we encounter frequently in the literature, but recycling method is not mostly preferred because of the some chemicals used in the recycling process [9] and also the mechanical recycling method lowers the quality of recycling products [10]. For this reason, upcycling method which known as a recycling process that transforms low-value materials into higher-value products [11] is appearing as an alternative method in the literature. Therefore, we prefer upcycling method which add value the textile waste and focused traditional handicraft works in this project.

Sixty percent of the total textiles is clothing and less than 1% of clothing waste is recycled into new clothes [4]. It is important to work on upcycling of the clothing waste in terms of environment, social and circular economy. Failing to utilize these clothing waste means that the petroleum, chemicals, water, and energy required to produce the same amount of raw materials are also being wasted [12]. Upcycling of the clohing waste may be an important opportunity for unemployed people because it is easy to reach clothing waste and they can adapt easily to handicraft works. Generally, municipalities and charitable organisations collect clothing waste. The people who wants to work on making handicraft products by using clothing waste, can get clothing waste from municipalities and charitable organisations.

According to a current report which prepared by Safranbolu Municipality (Türkiye) there are 35 clothing waste cans and local people put the clothing waste in these cans. And also according to this report the clothing waste amount for last 3 years as follows:

Year	**Waste (Tonnes)**
2021	54,22
2022	64,28
2023	84,07

The people who wants to work on making handicraft products by using clothing waste, can get the waste from municipalities and charitable organisations. Municipalities also can organise vocational trainings about making handicraft product by using clothing waste. This can be an opportunity for unemployed people.

Figure 3. A Weaver İn Rural India Making A Handloom Fabric [13]

Clothing waste can upcycle with some different handicraft works. It depends on some factors such as local culture, creativity, current needs, usefulness, etc. We organized some face to face meeting with 15 women in Safranbolu city (Türkiye) to research the local handicraft products which made by using textile waste and discussed about their works. They presented us the handicraft products which they made by using textile waste. Most of these products were made many years ago and are still in use today (Fig.6, 7, 8, 9, 10). They also stated that they participated a local training activity and created some handicraft products which made by using leather waste (Fig. 4, 5).

Figure 4. A Leather Handbag And Glasses Case

Figure 5. A Leather Wallet

Figure 6. A Rug Made By Using Clothing Waste

Figure 7. A Mat Made By Using String Waste

Figure 8. A Pillow Made By Using Clothing Waste

Figure 9. Socks Made By Using String Waste

Figure 10. A Duvet Cover Made By Using Clothing Waste

Besides, there are some samples about handicraft products such as pouchbag, ecobag, patchwork rug and portreit in the literatüre.

Figure 11. Pouchbags [14]

Figure 12. Bath Loofah Made By Using String Waste

Figure 13. A Patchwork Rug [13]

Figure 14. A Protre Made By Using Denim Waste, Choi So Young [15]

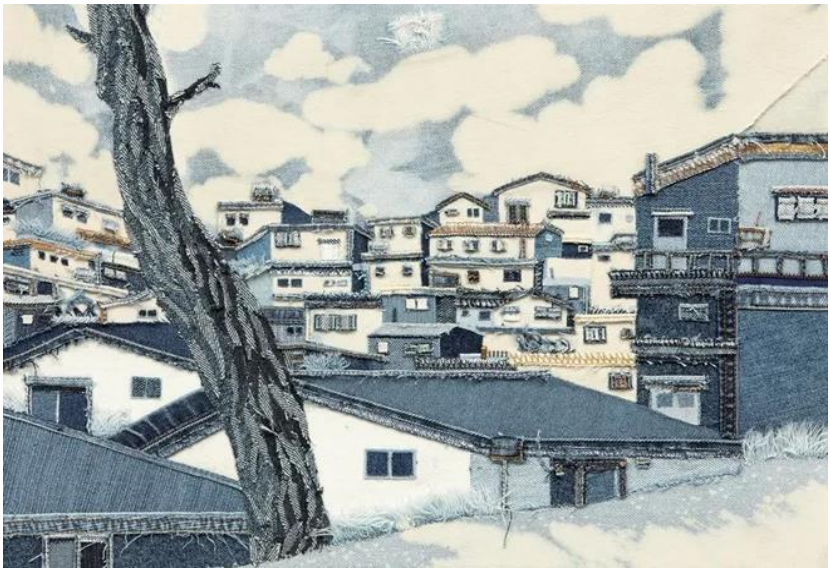

Figure 15. A Protre Made By Using Denim Waste, Choi So Young [16]

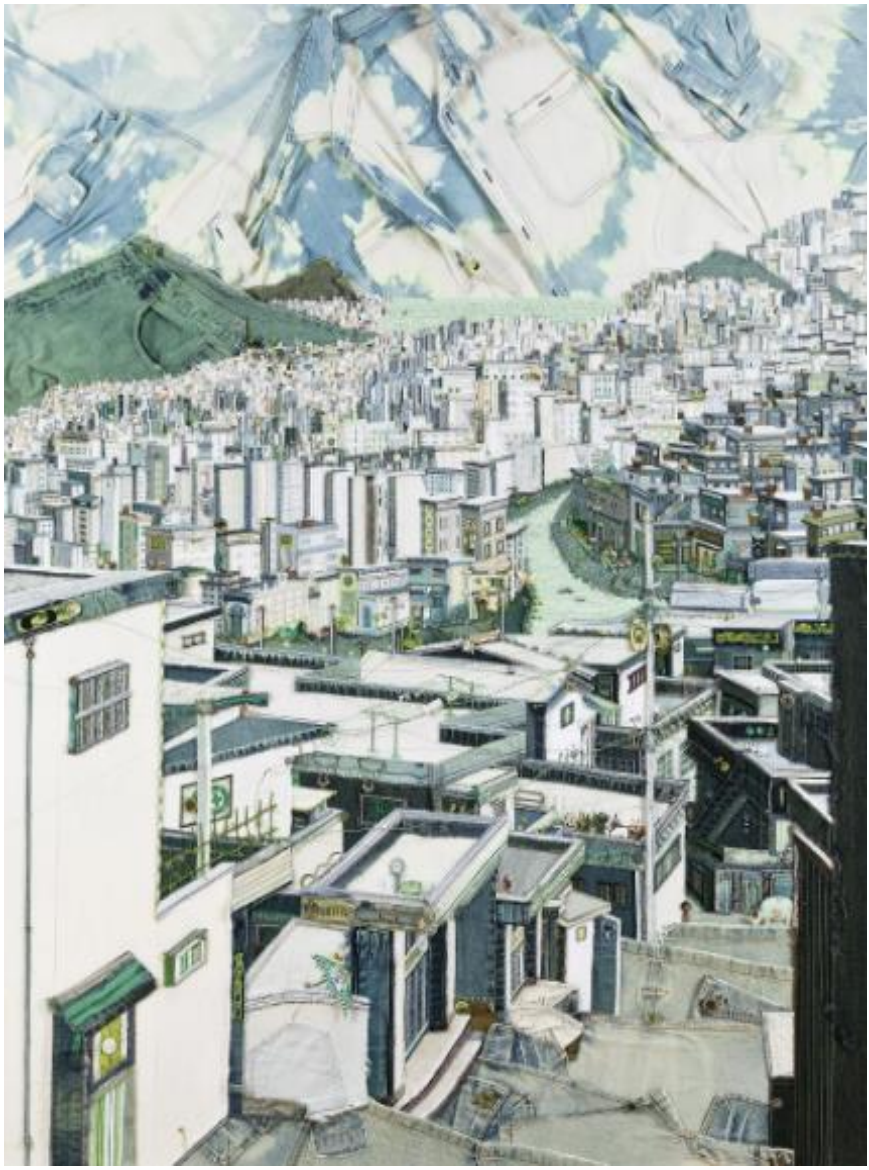

Figure 16. A Protre Made By Using Denim Waste, Choi So Young [16]

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CHAPTER - 3

Recycling in North Macedonia

Author:

Loreta ANDREEVSKA
Teacher, Special Educator and Rehabilitator
Primary school with resource center “Idnina”-Skopje
North Macedonia
lpandreevska@yahoo.com

Katerina VELICHKOVSKA
Teacher, Special Educator and Rehabilitator
Primary school with resource center “Idnina”-Skopje
North Macedonia
kate_veli@hotmail.com

INTRODUCTION

Recycling is the process of converting waste materials into new products to prevent waste, reduce consumption of fresh raw materials, and lower energy usage. Common recyclable materials include paper, cardboard, glass, metals and certain plastics. Recycling helps conserve natural resources, reduce pollution and minimize greenhouse gas emissions. Recycling in North Macedonia has been developing gradually, with efforts to improve waste management and promote recycling practices across the country. Here are some key points about recycling in Macedonia:

1. **Legislation and Policy**: North Macedonia has implemented laws and regulations to manage waste and promote recycling. These include the Law on Waste Management and various bylaws that regulate specific aspects of waste handling and recycling.
2. **Infrastructure**: The country is working on developing its recycling infrastructure. This includes the establishment of recycling centers, collection points, and sorting facilities to manage different types of waste.
3. **Public Awareness**: Increasing public awareness about the importance of recycling is a significant focus. Various campaigns and educational programs aim to encourage citizens to participate in recycling efforts and properly separate their waste.
4. **Recycling Programs**:North Macedonia has introduced several recycling programs targeting different types of waste, such as plastics, paper, glass, and electronic waste. These programs often involve partnerships between local governments, private companies, and non-governmental organizations.
5. **Challenges**: Despite progress, North Macedonia faces challenges in its recycling efforts. These include limited infrastructure, insufficient funding, and the need for greater public participation. Additionally, illegal dumping and improper waste disposal practices remain issues that need to be addressed.
6. **Initiatives and Projects**: There are various initiatives and projects aimed at improving recycling in Macedonia. For example, projects funded by international organizations, such as the European Union,

focus on enhancing waste management systems, supporting recycling industries, and promoting sustainable practices.

7. **Future Goals**: Macedonia aims to align its waste management and recycling practices with European Union standards. This includes increasing recycling rates, reducing landfill waste, and implementing more sustainable waste management solutions.

Overall, while North Macedonia is making strides in improving its recycling efforts, there is still work to be done to establish a comprehensive and efficient recycling system across the country.

RECYCLING AND SPECIAL NEEDS

Recycling programs can be adapted to accommodate individuals with special needs, ensuring inclusivity and accessibility. Here are some key considerations and strategies:

Educational Programs

1. **Visual Aids:** Use clear, visually engaging materials like posters, color-coded bins, and pictograms to explain recycling processes.
2. **Simplified Instructions:** Provide easy-to-understand instructions, possibly using simple language and step-by-step guides.
3. **Interactive Learning:** Utilize interactive activities, such as games or hands-on sorting exercises, to teach recycling concepts.

Accessibility

1. **Physical Accessibility:** Ensure that recycling bins are easily accessible to individuals with mobility impairments. This might include adjusting the height of bins and providing easy-to-use lids.
2. **Assistive Technology:** Implement technology, such as apps with voice commands or barcode scanners, to help individuals identify recyclable items.
3. **Support Services:** Offer support services, such as volunteers or aides, to assist individuals with special needs in recycling activities.

Community Involvement

1. **Inclusive Workshops:** Organize workshops and community events that are inclusive, encouraging participation from individuals with various abilities.

2. **Collaboration with Organizations:** Work with organizations that support individuals with special needs to develop tailored recycling programs.
3. **Feedback Mechanisms:** Establish channels for receiving feedback from individuals with special needs and their caregivers to continuously improve recycling programs.

Customized Solutions

1. **Personalized Plans:** Develop personalized recycling plans for individuals based on their specific needs and abilities.
2. **Adaptive Equipment:** Provide adaptive equipment, such as ergonomic tools for sorting and handling recyclables.
3. **Routine Integration:** Integrate recycling into daily routines in a way that is manageable and consistent for individuals with special needs.

By implementing these strategies, recycling programs can become more inclusive and supportive, ensuring that everyone has the opportunity to contribute to environmental sustainability.

TEXTILE RECYCLING

In our country is an emerging sector within the broader context of waste management and sustainability efforts. Here are some important aspects of textile recycling in the country:

1. **Current Practices**:
    - **Collection Points**: There are dedicated collection points for textiles, often organized by local municipalities or non-governmental organizations.
    - **Sorting and Processing**: Collected textiles are sorted based on their condition. Usable clothes may be donated or resold, while non-usable items are sent for recycling.
2. **Organizations and Initiatives**:
    - **NGOs and Social Enterprises**: Various non-governmental organizations and social enterprises are active in textile recycling. They often organize collection drives and awareness campaigns.
    - **Partnerships**: Collaborations between local governments, private companies, and international organizations help to

enhance the infrastructure and efficiency of textile recycling programs.

3. **Challenges**:
    - **Infrastructure**: There is a need for more advanced infrastructure to efficiently sort, process, and recycle textiles.
    - **Public Awareness**: Increasing awareness about the importance of textile recycling and how to participate is crucial for improving recycling rates.
    - **Economic Viability**: Ensuring that textile recycling is economically viable remains a challenge, as it requires investment in technology and facilities.

GLASS RECYCLING

In North Macedonia is an integral part of the country's efforts to improve waste management and promote environmental sustainability. Here are some key points about glass recycling in Macedonia:

Current Practices

1. **Collection Points and Bins**:
    - Glass recycling bins are placed in various locations, such as residential areas, public spaces, and near commercial establishments.
    - Specific collection points are designated for different types of glass waste, including bottles, jars, and other glass containers.
2. **Sorting and Processing**:
    - Glass waste is collected and transported to recycling facilities where it is sorted based on color and type.
    - The sorted glass is then cleaned, crushed, and melted to be reused in the production of new glass products.

Organizations and Initiatives

1. **Municipal Initiatives**:
    - Local municipalities play a significant role in organizing and managing glass recycling programs. They often collaborate with private companies and NGOs to enhance recycling efforts.
2. **Private Sector**:

- Various private recycling companies are involved in collecting and processing glass waste. These companies often partner with beverage producers, restaurants, and other businesses to source recyclable glass.

3. **Public Awareness Campaigns**:
    - Educational programs and campaigns are conducted to inform the public about the importance of glass recycling and how to participate effectively.

Challenges

1. **Infrastructure**:
    - The need for more recycling facilities and better collection infrastructure is a significant challenge.
2. **Public Participation**:
    - Ensuring high levels of public participation and proper sorting of glass waste can be difficult.
3. **Economic Factors**:
    - Making glass recycling economically viable requires addressing issues related to the cost of collection, transportation, and processing.

Benefits of Glass Recycling

1. **Environmental Impact**:
    - Recycling glass reduces the need for raw materials, conserves natural resources, and lowers energy consumption compared to producing new glass.
    - It also reduces the volume of waste sent to landfills.
2. **Energy Savings**:
    - Recycling glass saves a significant amount of energy as melting recycled glass requires less energy than producing glass from raw materials.
3. **Economic Opportunities**:
    - The glass recycling industry can create jobs and stimulate economic growth through the development of recycling infrastructure and related activities.

Future Prospects

1. **Policy and Legislation**:

- Strengthening policies and regulations can provide a framework for more effective glass recycling and encourage investments in this sector.

2. **Technological Advancements**:
   - Investing in modern recycling technologies can improve the efficiency of glass recycling processes and increase the quality of recycled glass products.
3. **Circular Economy**:
   - Promoting a circular economy approach, where glass products are designed for recyclability, can enhance sustainability in the glass industry.

By addressing the challenges and leveraging the benefits, Macedonia can improve its glass recycling efforts, contributing to a more sustainable and environmentally friendly waste management system.

PAPER RECYCLING

Here are key aspects of paper recycling in Macedonia:

Current Practices

1. **Collection Systems**:
   - **Residential**: Households are encouraged to separate paper waste from other types of waste. Collection bins for paper are provided in many residential areas.
   - **Commercial and Institutional**: Businesses, schools, and other institutions often have dedicated paper recycling programs and collection points.
2. **Sorting and Processing**:
   - Collected paper is transported to recycling facilities where it is sorted by type and grade (e.g., newspapers, cardboard, office paper).
   - The sorted paper is then cleaned to remove contaminants such as ink, plastic, and adhesives before being processed into pulp and used to produce new paper products.

Organizations and Initiatives

1. **Municipal Programs**:

- Local governments run recycling programs that include the collection and processing of paper waste. They may also collaborate with private companies and NGOs to enhance recycling efforts.

2. **Private Sector Involvement**:
   - Various private recycling companies are actively involved in the collection and processing of paper waste. These companies may work with businesses and institutions to manage large volumes of paper waste.
3. **Public Awareness Campaigns**:
   - Campaigns and educational programs aim to raise awareness about the importance of paper recycling and encourage public participation.

Challenges

1. **Infrastructure**:
   - There is a need for more recycling facilities and improved collection infrastructure to handle the volume of paper waste effectively.
2. **Public Participation**:
   - Increasing public participation and ensuring proper sorting of paper waste are ongoing challenges.
3. **Economic Viability**:
   - Ensuring that paper recycling is economically viable involves addressing costs related to collection, transportation, and processing.

Benefits of Paper Recycling

1. **Environmental Impact**:
   - Recycling paper reduces the need for raw materials, conserves forests, and lowers energy consumption compared to producing paper from virgin materials.
   - It also decreases the volume of waste sent to landfills, reducing environmental pollution.
2. **Energy and Resource Conservation**:
   - Recycling paper saves energy and water and reduces greenhouse gas emissions associated with the production of new paper.

3. **Economic Opportunities**:
    - The paper recycling industry creates jobs and stimulates economic growth by developing recycling infrastructure and related activities.

Future Prospects

1. **Policy and Legislation**:
    - Strengthening policies and regulations can provide a framework for more effective paper recycling and encourage investments in this sector.
2. **Technological Advancements**:
    - Investing in modern recycling technologies can improve the efficiency of paper recycling processes and increase the quality of recycled paper products.
3. **Circular Economy**:
    - Promoting a circular economy approach, where paper products are designed for recyclability, can enhance sustainability in the paper industry.

Efforts to improve paper recycling in Macedonia are part of a broader commitment to sustainable waste management and environmental conservation. With continued investment and public engagement, the country can enhance its paper recycling rates and contribute to global sustainability goals.

WOOD RECYCLING

Wood recycling in Macedonia is an important part of sustainable waste management, focusing on reusing and repurposing wood materials to reduce waste and conserve natural resources. Here are key points about wood recycling in Macedonia:

Current Practices

1. **Sources of Wood Waste**:
    - **Construction and Demolition**: Wood waste from construction sites, demolition projects, and renovations.
    - **Industrial**: Wood scraps and offcuts from manufacturing processes, such as furniture production.

- **Household**: Discarded wooden furniture, pallets, and other household items.

2. **Collection and Sorting**:
   - Wood waste is collected from various sources and sorted based on type and condition. Reusable wood is separated from wood that needs to be processed further.
   - Collection points and facilities are established to gather wood waste from construction sites, businesses, and households.

Processing and Recycling

1. **Reuse**:
   - Reusable wood, such as pallets and beams, is often refurbished and used in new construction projects or sold as reclaimed wood for various purposes.
2. **Recycling**:
   - Wood that cannot be reused is processed into wood chips, mulch, or sawdust. These materials can be used in landscaping, agriculture, or as biomass for energy production.
   - Some recycled wood is used to produce composite materials, such as particleboard and fiberboard, which are used in furniture and construction.

Organizations and Initiatives

1. **Municipal Programs**:
   - Local governments often run recycling programs that include the collection and processing of wood waste. They may collaborate with private companies and NGOs to enhance recycling efforts.
2. **Private Sector**:
   - Various private companies are involved in collecting, processing, and recycling wood waste. These companies may specialize in specific types of wood recycling, such as pallet refurbishment or biomass production.
3. **NGOs and Community Initiatives**:
   - Non-governmental organizations and community groups sometimes organize wood recycling projects and awareness campaigns to promote sustainable practices.

Challenges

1. **Infrastructure**:
    - Developing sufficient infrastructure for collecting, sorting, and processing wood waste is a significant challenge.
2. **Public Awareness**:
    - Increasing public awareness about the importance of wood recycling and how to participate effectively is crucial for improving recycling rates.
3. **Economic Factors**:
    - Ensuring that wood recycling is economically viable requires addressing issues related to the cost of collection, transportation, and processing.

Benefits of Wood Recycling

1. **Environmental Impact**:
    - Recycling wood reduces the need for virgin timber, conserving forests and natural habitats.
    - It also reduces the volume of waste sent to landfills and lowers greenhouse gas emissions associated with wood decomposition.
2. **Resource Conservation**:
    - Recycling wood conserves natural resources and reduces the environmental impact of logging and wood processing.
3. **Economic Opportunities**:
    - The wood recycling industry creates jobs and stimulates economic growth through the development of recycling infrastructure and related activities.

Future Prospects

1. **Policy and Legislation**:
    - Strengthening policies and regulations can provide a framework for more effective wood recycling and encourage investments in this sector.
2. **Technological Advancements**:
    - Investing in modern recycling technologies can improve the efficiency of wood recycling processes and increase the range of products made from recycled wood.
3. **Circular Economy**:

- Promoting a circular economy approach, where wood products are designed for longevity, reuse, and recyclability, can enhance sustainability in the wood industry.

Efforts to improve wood recycling in Macedonia are part of a broader commitment to sustainable waste management and environmental conservation. With continued investment and public engagement, the country can enhance its wood recycling rates and contribute to global sustainability goals.

PLASTIC RECYCLING

Plastic recycling in Macedonia is crucial for reducing environmental pollution, conserving resources, and managing waste sustainably. Here are some key aspects of plastic recycling in Macedonia:

Current Practices

1. **Collection Systems**:
   - **Residential**: Households are encouraged to separate plastic waste. Collection bins for plastics are often provided in residential areas.
   - **Commercial and Institutional**: Businesses, schools, and other institutions often have dedicated plastic recycling programs.
2. **Sorting and Processing**:
   - Collected plastic waste is transported to recycling facilities where it is sorted by type (e.g., PET, HDPE, LDPE).
   - The sorted plastic is cleaned to remove contaminants before being shredded, melted, and formed into pellets for reuse in manufacturing new plastic products.

Organizations and Initiatives

1. **Municipal Programs**:
   - Local governments run recycling programs that include the collection and processing of plastic waste. They may collaborate with private companies and NGOs to enhance recycling efforts.
2. **Private Sector**:

- Various private recycling companies are actively involved in collecting and processing plastic waste. These companies often work with businesses and institutions to manage large volumes of plastic waste.

3. **Public Awareness Campaigns**:
    - Campaigns and educational programs aim to raise awareness about the importance of plastic recycling and encourage public participation.

Challenges

1. **Infrastructure**:
    - Developing sufficient infrastructure for collecting, sorting, and processing plastic waste is a significant challenge.
2. **Public Participation**:
    - Increasing public participation and ensuring proper sorting of plastic waste are ongoing challenges.
3. **Economic Viability**:
    - Ensuring that plastic recycling is economically viable involves addressing costs related to collection, transportation, and processing.

Benefits of Plastic Recycling

1. **Environmental Impact**:
    - Recycling plastic reduces the need for new plastic production, conserving resources and lowering energy consumption.
    - It also reduces the volume of plastic waste sent to landfills and decreases pollution, including marine and terrestrial litter.
2. **Energy and Resource Conservation**:
    - Recycling plastic saves energy compared to producing new plastic from raw materials. It also conserves natural resources such as petroleum.
3. **Economic Opportunities**:
    - The plastic recycling industry creates jobs and stimulates economic growth through the development of recycling infrastructure and related activities.

Future Prospects

1. **Policy and Legislation**:
    - Strengthening policies and regulations can provide a framework for more effective plastic recycling and encourage investments in this sector.
2. **Technological Advancements**:
    - Investing in modern recycling technologies can improve the efficiency of plastic recycling processes and increase the quality of recycled plastic products.
3. **Circular Economy**:
    - Promoting a circular economy approach, where plastic products are designed for recyclability, can enhance sustainability in the plastic industry.

Efforts to improve plastic recycling in North Macedonia are part of a broader commitment to sustainable waste management and environmental conservation. With continued investment and public engagement, the country can enhance its plastic recycling rates and contribute to global sustainability goals.

CONCLUSION

In conclusion, recycling plays a crucial role in promoting environmental sustainability and conserving valuable resources. By reprocessing materials and reducing waste, we can significantly decrease our ecological footprint and help protect the planet for future generations. Engaging in recycling not only contributes to a cleaner environment but also fosters a culture of responsibility and awareness about our consumption habits. By making a conscious effort to recycle, we can collectively create a positive impact and work towards a more sustainable future.n conclusion recycling.

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CHAPTER - 4

Recycling in Preventing Environment and Climate Change

Author:

Arif ÖZDEMIR

Yaşama Sevinci Special Training Vocational School, Project Coordinator and Educational Institution, Karabük
arse7678@hotmail.com

INTRODUCTION

"The environment is the physical, biological, social, economic and cultural environment in which humans and other living things maintain their relationships and interact with each other throughout their lives. It is the environment we live. The environment is the nature around us and even our future. Breaks in the links of the chain that make up the natural balance affect the whole chain and have caused the balance to deteriorate. The most important factor in the deterioration of the balance is human. Because every behavior and every innovation made by humans for survival and benefit affects the natural balance. " [3]

In order for living things to continue their lives in a healthy way, it is necessary to be a healthy environment. Among the elements of healthy environment, nature, has a systematic and orderly network of relationships, and thanks to this systematically functioning order, all living things in our world can continue their lives in a healthy way. The deterioration of the regularly functioning system in the relations between the elements of the environment is usually caused by human-induced reasons. Disruptions in the elements of the network of regular relationships cause the environment to begin to deteriorate and environmental problems to arise. It is observed that human-induced factors have an important place in the deterioration of the natural balance and the emergence of environmental problems. "The intensive mixing of foreign substances that adversely affect the living and non-living elements of the environment, cause structural damages on them and deteriorate their qualities into air, water and soil is called environmental pollution" (Subaşı-Aydın, 2023: 43).

The deterioration of the natural balance, which is necessary for all living things to sustain their lives in a healthy way, is a result of the pollution of the environment due to various reasons. With the pollution of the natural environment, which is the common living space of all living things, the balance of the nature ecosystem is also disrupted and as a result, strange changes are observed in the climate. In order to protect the natural balance

[3] *https://usak.csb.gov.tr/cevre-nedir-i-1670, Date of Access:17.06.2024*

and ensure the sustainability of the balance in the nature system, measures should be taken against environmental pollution; waste management strategies should be developed against wastes that pollute the environment. In the context of waste management, governments and local administrations should prioritize this issue.

"The collection of waste materials such as metal, glass, plastic, paper, textile, etc. by various methods and their reprocessing, reproducing and making them usable have been called recycling." (Gündüzalp-Güven, 2016: 1). With recycling, natural balance can be preserved and climate changes can be prevented. It should be aimed to bring the waste materials produced back into the economy and thus, the natural balance should be protected by preventing the reckless consumption of natural resources that are seen as unlimited.

ENVIRONMENTAL POLLUTION

"Environment is a physical, chemical, biological, social, economic and cultural environment in which humans and other living things maintain their relations and interact with each other throughout their lives. Environmental pollution basically has occurred in nature in the form of air, soil and water pollution and ultimately has affected the entire ecosystem, including humans." (Esen, 2019: 1).

As a result of industrialization and unplanned urbanization, too much produced waste's unconsciously throw and release wastes into the environment by humans causes air, water and soil pollution and this situation adversely affects the quality of life and health of human beings. As a result of the pollution of our planet Earth, which is the common habitat of all living things, with the wastes produced by human beings, the governments and local administrations in all countries with the problem of environmental pollution, which causes the balance of nature to deteriorate and the climate to change; by developing waste management strategies, they need to prepare serious action plans to fight environmental pollution prevention. "Human beings have smoothly benefited from basic resources such as air, water and soil for a long time in a healthy environment characterized as natural balance. However, today, the need for space, energy and raw materials, which emerged as a result

of rapid population growth and technological developments, has made it necessary to utilize natural environments and resources too much." (Kahyaoğlu-Kaya, 2012: 92).

Figure 1. Envıronmental Pollutıon. https://www.enerjigunlugu.net/who-cevre-kirliligi-her-yil-12-6-milyon-insani-olduruyor-23154h.htm 29.06.2024)

When we look at the factors that pollute our environment, we can generally say that the rapid increase in population in the world, unplanned urbanization seen with rapid population growth, rapid development of technology and of industrialization, reckless and unrestrained use of natural resources that are seen as unlimited. Air, soil and water resources are polluted with environmental pollution. These pollutions begin to disrupt the balance of nature and cause damage to all living creatures living in nature. "Considering the diversity and dimensions of the environmental problems experienced; today, rapid developments in the field of industry and technology have provided an increase in the level of life, while on the other hand, it has resulted in the deterioration of the natural balance, the destruction of resources and the formation of a situation that threatens living life." (Mutlu-Tokcan,2012:66). Environmental pollution causes climate changes by disrupting the balance structure of the nature ecosystem. It is possible for all

living creatures to lead a healthy life with a clean environment where the balance of nature is preserved and the ecosystem is intact.

CLIMATE CHANGE

What is climate?

"Climate is called the average of meteorological phenomena such as temperature, humidity, air pressure, wind, precipitation, rainfall pattern observed in a place over a long period of time."[4] Climate differs from weather. Climate is shaped according to the situation formed by observing meteorological events in a place for a long time. Weather, on the other hand, refers to the weather changes that occur in the atmosphere in a short period of time in a place.

Climate in a region is formed depending on the distance of that region to the sea, the characteristics of the landforms, the elevation of that place, the permanent snow conditions. When we look at the world scale, climate is classified according to its types. In the classification of climate, conditions such as temperature and precipitation regime of the region where life is lived are taken into consideration.

Greenhouse Gas Impact

"Compounds consisting of gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), fluorocarbons (PFCs), sulfur hexafluoride (SF6), that have the ability to retain heat in the atmosphere are called greenhouse gases. In addition, the rays and light coming from the sun pass through the atmosphere by filtering heat the earth and the heat loss in the earth is prevented by the atmosphere; the ability of the atmosphere to transmit and retain heat is called the greenhouse gas effect. The atmosphere has the ability to transmit light and retain heat. Thanks to the ability of the atmosphere to retain heat, the temperature of the water remains balanced. Thus, the freezing of rivers and oceans is prevented. The

[4] *Climate, https://tr.wikipedia.org/wiki/%C4%B0klim, Date of Access: 18.06.2024*

heating and insulating effect of the atmosphere formed in this way is the greenhouse effect." (Özmen, 2009: 42-43).

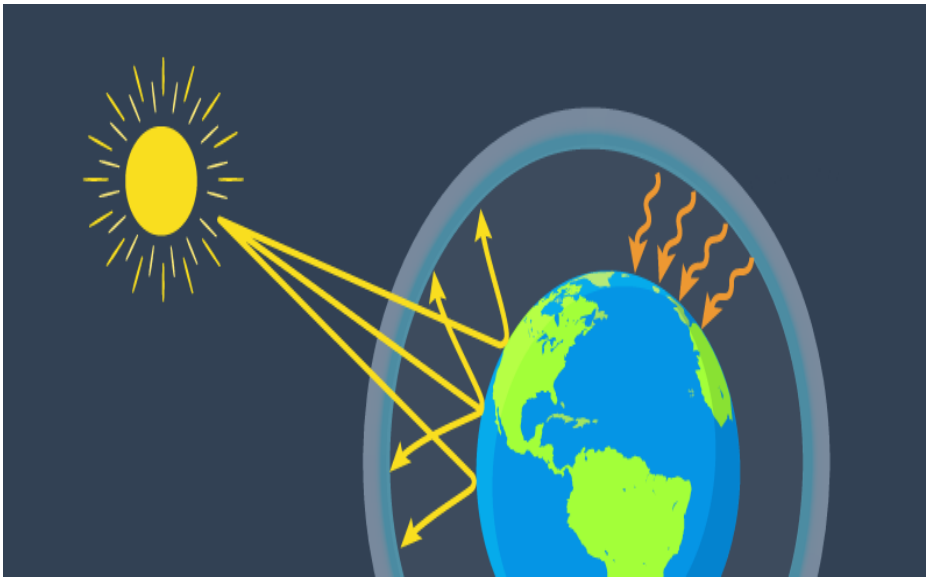

Figure 2. Greenhouse Effect (https://metsims.com/tr/sera-etkisi-nedir/. 29.06.2024)

With the industrial revolution, significant changes in greenhouse gases have been caused by human beings on a global scale. Humankind is the main factor responsible for changes in greenhouse gases, causing changes in the earth's temperature and thus causing global warming or global cooling, leading to climatic changes around the world.

"As a result of various human activities such as the burning of fossil fuels, industrial processes, land use changes and deforestation, the accumulation of important greenhouse gases in the atmosphere has been increasing rapidly since the industrial revolution and the natural greenhouse effect has been strengthened. The most important and clear effect of the strengthening greenhouse effect is to warm the Earth's climate by creating an additional positive radiative forcing on the Earth's energy balance. The observed increase in global average surface temperatures during the period

CO2emissions.
"Fossil Fuel"[5] CO2 Release.
Billion Tonnes.

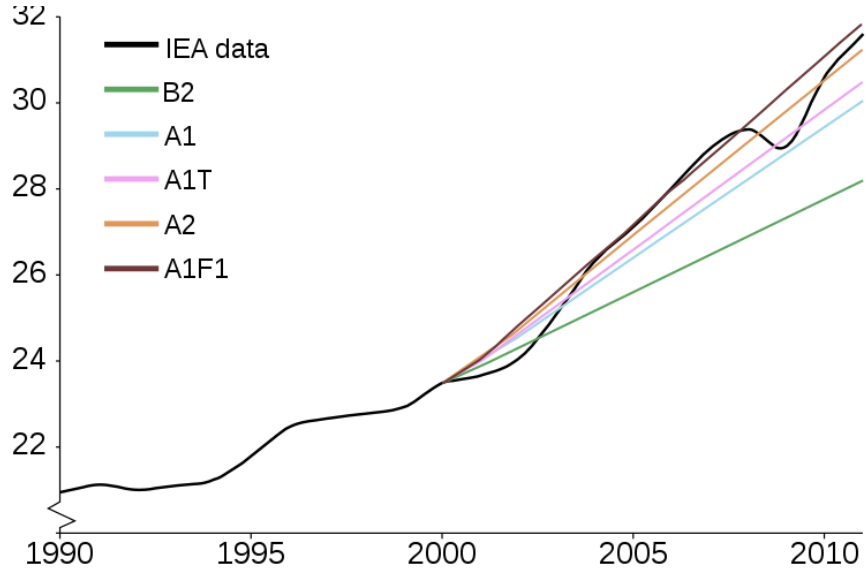

Figure 3. IEA[6] CO2 Emissions According to IPCC[7]. Scenarios (https://tr.wikipedia.org/wiki/%C4%B0klim_de%C4%9Fi%C5%9Fikli%C4%9Fini_hafifletme 29.06.2024)

1906-2005 is 0.74 °C. Increases in atmospheric accumulations of greenhouse gases are expected to lead to regional and global changes in variables such as temperature, precipitation, humidity and wind. The most advanced climate models predict a likely increase of between 2-4.5°C for the period 1990-2100, with a best estimate of around 3°C, in global average surface temperatures. Depending on the increases in global temperatures, significant changes are predicted to occur that will directly affect socio-economic sectors, ecological systems and human life, such as changes in the hydrological cycle, melting of land glaciers and sea ice, sea level rise, increased intensity and frequency of

[5] *Fossil Fuel: Fuels such as coal, oil and natural gas.*
[6] *International Energy Agency.*
[7] *International Panel on Climate Change.*

heat waves, extreme high precipitation and floods in some regions, and more severe and frequent droughts in some regions." (Türkeş, 2008: 1).

Degrees Centigrade ^{0}C

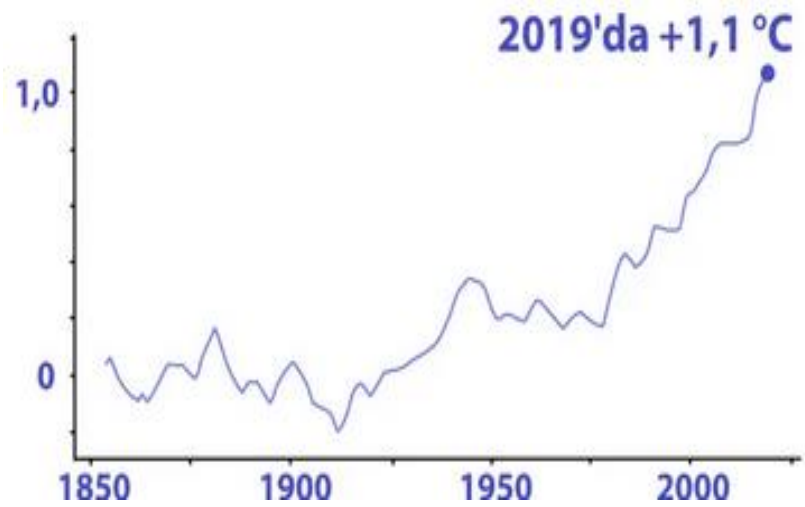

Figure 4. Temperature Increase (https://climatescience.org/tr/advanced-greenhouse-effect 29.06.2024)

Environment and Climate Change Relationship

Today, climate crises are being experienced with the impact of global scale environmental problems. The emergence of environmental pollution as quite a big problem on a global scale in front of humanity and the development of technology with the influence of human beings, the immoderately release of greenhouse gases into the atmosphere with the rapid increase in industrialization, the accumulation of greenhouse gases in the atmosphere at rates considerably higher than the required values have led to the emergence of the problem of global warming.

Figure 5. Global Climate Change (https://dunyalilar.org/kuresel-iklim-degisiklikligi-gecmis-ve-gelecek.html/ 29.06.2024)

"Global warming is a formation that threatens the holistic structure of the ecosystems in which life in the world is sustained, causes the extinction of thousands of plant and animal species, affects human life, and causes an increase in other meteorological disasters such as overtemperature, fire, thirst, drought." (Özmen, 2009: 42).

As a result of the uncontrolled and unconscious release of the required emission values of greenhouse gases being in the atmosphere to the environment uncontrollably and unconsciously with industrialization, changes occur in the ability of the atmosphere to transmit and retain heat, thus causing climates to change, and this situation is very negative.

"In its Report on the Physical Basis of Climate Change, the first of the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC), which brings together the most comprehensive and up-to-date scientific studies on climate change, it is stated that the risks related to climate change will be earlier and more dangerous than expected. The report warns that our world is 1.20 °C warmer compared to the pre-industrial period, and that the effects of climate change will also increase exponentially in cases the temperature increase is 1.50 °C or 20 °C.The devastating and shocking events

that our world has faced in the recent past, such as fires in California, Siberia, Greece and Turkey; floods in Europe, China and India; and heat waves in Siberia and Canada, are considered by scientists to be the consequences of the 1.20 °C increase in global temperature. However, while the warnings continue, the fact that temperatures continue to rise means that the destructive effects will also increase." (Birpınar, 2022: 21).

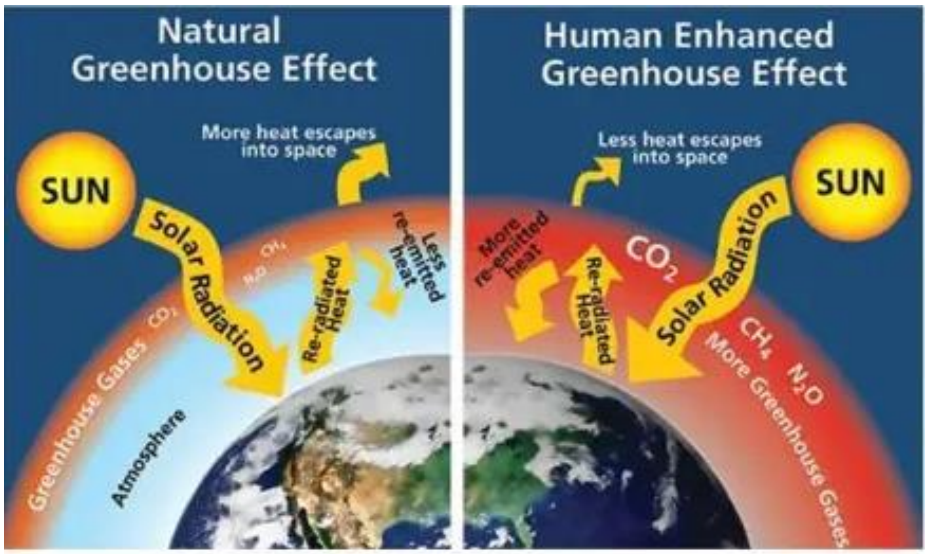

Figure 6. Greenhouse Effect (https://temizdunyaicinkimya.wordpress.com /sera-etkisi-2/sera-etkisi/ 29.06.2024)

We can say that environmental pollution is one of the most important problems of mankind on a global scale. Human beings are seen as the leading factor in the formation of environmental pollution. On a global scale, governments and local administrations should take measures to raise awareness of environmental sensitivity, primarily by using visual and audio mass media, by drawing attention to the public through the press, and by raising awareness by providing environmental education to children in schools. It is obvious that the sensitive and conscious behavior of all societies of the world against environmental pollution will be a very important priority in preventing pollution of the environment.

THE IMPORTANCE OF RECYCLING

"Recycling is called by which wastes that have the possibility of being recycled are transformed into raw materials or by-products through various processes and re-participated in production. A significant portion of solid wastes (such as paper, tin, glass) are recyclable products." (Çimen-Yımaz, 2012:65)

Figure 7. The Importance of Recycling (https://www.hurdacimuhsin.com/geri-donusum-nedir-ve-geri-donusumun-onemi/ 29.06.2024)

The importance of recycling has been increased by the gradual decrease in natural resources, which have an important place in our lives and which seem to be unlimited, environmental pollution caused by the wastes produced, global warming and negative developments due to the change in the climate seen in this context. Recycling will make positive contributions to the economy, the environment and the fight against climate change. In general, the vast majority of the wastes produced can be recycled. Among the wastes produced, plastic, paper, glass, metal and fabric are the most common wastes to be recycled. With recycling, it is aimed to recycle solid wastes such as

metal cans, glass bottles, plastic wastes, paper and cardboard wastes, textile wastes into the economy. At the same time, since recycling has an important contribution to the fight against environmental and climate change, governments and local administrations on a global scale should give priority and importance to this issue.

Figure 8. Recycle (https://sps.com.tr/blog/geri-donusum-nedir-nasil-yapilir 29.06.2024)

"One of the important environmental problems of today is solid waste. Solid wastes are wastes generated as a result of people's social, domestic and industrial activities. As a result of the increase in population and developments in technology, the amount and type of solid wastes have also increased. Solid wastes can remain intact in nature for a long time, cause environmental pollution and negatively affect human health. The most important way to reduce waste generation and resource consumption is recycling and reuse. Waste that will be generated after production and consumption can be reused. Quality raw materials or by-products can be obtained, reused, and energy can be obtained." (Çimen-Yımaz, 2012: 64-65)

The negative effects of solid waste materials produced by recycling on the environment and economy can be reduced, and environmental

pollution and destruction of natural resources can be prevented. Thus, the balance of nature will be preserved through recycling and threats that adversely affect the healthy life of living beings caused by environmental pollution will be prevented. At the same time, since greenhouse gas emission values will remain at normal accepted levels with recycling, climatic changes will also be prevented, in other words, the negativities caused by global warming caused by the greenhouse gas effect (since the amount of CO2 emission to the atmosphere will decrease with the recycling of wastes and the greenhouse gases in the atmosphere will remain at normal accepted measurement values) will also be prevented. In addition, the wastes produced can be recycled into new raw material inputs that factories need.

Figure 9. Recycle (https://chemlife.com.tr/plastik-geri-donusum-sektoru-son-donemecte. 29.06.2024)

Thus, by preventing the unconscious consumption of natural resources, which are seen as unlimited, new raw materials produced by recycling waste can be used as new raw material inputs needed by the industry. Thus, with the recycling of wastes on a global scale, negativities such as health problems caused by environmental pollution problems, global warming caused by the effect of greenhouse gases, natural disasters caused by climatic changes can be prevented.

CONCLUSION

The unconscious consumption of natural resources by human beings leads to the deterioration of the balance of nature and this situation causes environmental pollution problems on a global scale and adversely affects the climate. This situation increases the importance of recycling considerably in terms of its positive contribution to preventing environmental pollution and combating climate change. The gradual decrease in natural resources, which have an important place in our lives and are seen as the raw material source of the industry, due to unconscious consumption, environmental pollution caused by wastes, climatic changes that occur with the negativities caused by global warming caused by the effect of greenhouse gases reaching abnormally increased values in the atmosphere; reduce the quality of life of human beings and cause various health problems. The negative developments seen as a result of the deterioration of the ecosystem caused by environmental pollution caused by human beings increase the importance of recycling activities even more. Recycling aims to obtain new, functional products with economic value from waste materials, to prevent environmental pollution problems that threaten human health and to prevent climatic changes.

With the Industrial Revolution, negative situations such as unplanned urbanization, excessive increase in urban population, intensive migration from rural areas to cities have created the problem of environmental pollution. At the same time, unconscious consumption of natural resources by human beings due to the need for raw materials required by the industry has led to the formation of environmental and climate change problems. The solid wastes produced need to be controlled and waste must be recycled by governments and local governments that have adopted world-class conscious waste management strategies in order to leave a healthy future for human beings. If waste can be recycled by human beings, as the problem of environmental pollution will be prevented to a great extent, climatic changes will not be seen, and thus we can leave a healthy, clean and developed living space for future generations.

Natural resources, which are seen as unlimited with the effect of industrialization and urbanization in the world, are used unconsciously and wastes are generated as a result of this irresponsible consumption. These wastes appear as an environmental problem. Environmental problems caused

by waste disrupt the balance of nature, negatively affect healthy life and also cause climate change. In order to maintain the balance of nature, waste management strategies should be developed and waste management policies should be included in the priority planning of the country or city management by the relevant country and city administrators.

If country and city administrators prioritize waste management policies, environmental problems caused by waste can be prevented through recycling practices. Thus, the natural balance, which is indispensable for a healthy life, will be preserved through recycling. With recycling, solid wastes will be re-evaluated and processed and a new product will be brought back to the economy. In other words, with recycling, functional, usable new products with economic value will be obtained from wastes. Thus, with recycling, the natural environment will be protected and since the ecosystem of nature maintains its balance, climate change problems will not be seen in nature.

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CHAPTER - 5

Recycling of Metals and Plastics In Italy

Author:

Ferdinando COMERCI

Presidente Ass. Giovani per l'Europa
Giovani per l'Europa, registro n. 50 delle Persone Giuridiche della Regione Calabria, Italy, Nicotera
E-mail: comercif@yahoo.it

Recycling of Metals and Plastics In Italy

In Italy, the recycling of metals and plastics is regulated by specific legislation and organized through a system of separate collection and dedicated consortia. Here is a detailed overview of the process and the directives that regulate it, but first, we want to give this statistic: (Fig. 1)

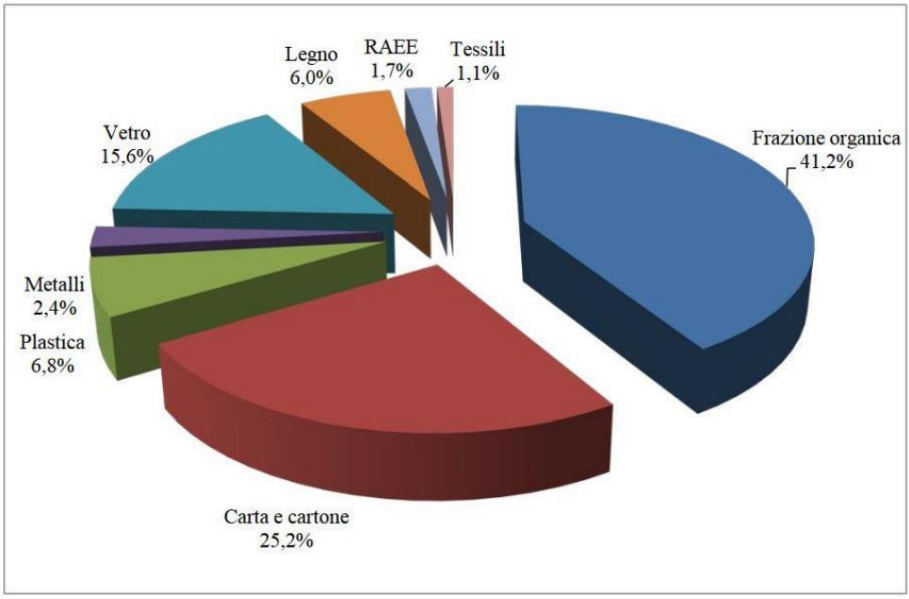

Figure 1. Elaborazioni ISPRA

Metal Recycling

Process Steps:

1. Collection:
   Domestic: Citizens separate metal waste (such as cans and packaging) and deposit it in designated containers. –
   Industrial: Companies collect metal waste produced during production processes (Fig. 2).
2. Transport: Metal waste is transported to collection centers or recycling plants.
3. Sorting and Separation:
   At collection centers, metals are separated from other materials.

Magnets and other separation systems are used to distinguish ferrous metals from non-ferrous metals.

Figure 2. Metal Recycling

4. Cleaning and Preparation:
   Metals are cleaned to remove impurities such as paint and organic residues.
   They are then shredded or pressed into bales.

5. Melting:
   Cleaned metals are melted in foundries at high temperatures.

6. Refining and Casting:
   After melting, metals may be further refined.
   The molten metal is cast into molds to form ingots or semi-finished products.

7. Reuse:
   Recycled metals are used to produce new products.

Directives:

Legislative Decree 152/2006 (Environmental Code): Regulates waste management, including metal recycling.

CONAI (National Packaging Consortium) and CIAL (Aluminum Packaging Consortium): Coordinate the collection and recycling of metal packaging.

Plastic Recycling

Process Steps: (Fig. 3)

1. Collection:
   Domestic: Citizens separate plastic waste (such as bottles and packaging) and deposit it in specific containers. - Industrial: Companies collect plastic waste from production processes.

2. Transport:
   Plastic waste is transported to collection centers or recycling plants.

3. Sorting and Separation:
   At collection centers, plastic is separated by type and color. - Automated sorting technologies, such as infrared spectroscopy, are used to identify different types of plastic.

4. Cleaning and Shredding:
   Plastic is washed to remove contaminants.
   It is then shredded into small pieces called flakes.

5. Melting and Granulation:
   Plastic flakes are melted and transformed into granules.
   Granules can be used as raw material for new plastic products.

6. Reuse:
   Recycled plastic is used to produce new items, reducing the need for virgin plastic.

Figure 3. Plastic Recycling

Directives:
Legislative Decree 152/2006 (Environmental Code): Regulates waste management, including plastics.
COREPLA (National Consortium for the Collection, Recycling, and Recovery of Plastic Packaging): Coordinates the collection and recycling of plastic packaging.

Conclusion

The recycling of metals and plastics in Italy is a well-structured process regulated by legislation that ensures efficient and sustainable waste management. Through separate collection and the work of consortia, the country successfully recovers valuable materials and reduces the environmental impact of waste.

CHAPTER - 6

The Use of Glass Waste in the Recycling of Art Decorative Waste Glass Art

Author:

Şerife EROĞLU YALÇIN

Teacher, Ministry of Education Karabük Yaşama Sevinci Special Education Vacational School, Handicraft Technology Teacher and Head of the Department, Karabük, Türkiye**.**

serifeerogluyalcin@gmail.com

Arif Özdemir

Teacher, Yaşama Sevinci Special Training Vocational School, Project Coordinator and Educational Institution, Karabük

arse7678@hotmail.com

INTRODUCTION

In the majority of developed and developing countries in our era, many materials (paper, plastic, glass, metal, textiles, etc.) rather than its obsolescence and disposable product outlook, in our modern world; due to consumer craze, outdated and continuing indifference to the depletion of natural resources, pollution problems are increasing, our natural resources are running out, and environmental pollution continues to increase in such a way that there is no recycling.

In this context, the pollution that is increasing as a result of people's activities every day is increasing due to the damage caused to nature and our world by products that are used unconsciously, and the possibility of nature's self-cleaning is gradually decreasing. Recycling of waste materials is one of the most effective methods of dealing with environmental pollution. Glass has taken its place among the wastes that we call domestic solid waste, the majority of which are solid decays.

Glass, which has existed in our lives for millions of years, has a very long history. Since the moment it has existed, it has taken part in our daily life, art, science, technology and many other fields and continues to take part.

Glass is a solid material with an inorganic amorphous structure that is transparent or translucent, usually hard, brittle and allows the preservation of liquids. Since ancient times, glass has been used both as a construction material and as an ornamental object. Today, there is still a very common field of use from simple tools to communication and space technologies. For example; it has widespread practical, technological and decorative use in window panes, glass packaging, mirrors, lamps, tableware and optics [URL-1].

The production and use of glass is more numerous during the Roman Empire than at any other time in history, because the Second Roman Emperor Tiberius established a glass industry in Rome for local customers. At the same time, glass production also developed in every country under Roman rule (Egypt, Syria, Greece, Italy, Gaul and the western provinces of Britain). Before long, Western European glass manufacturers learned to make glass themselves instead of importing ingots and processing them in secondary

workshops. Although the Roman Empire collapsed, glass production continued. In the Middle Ages, glass art was renovated; stained glass windows were used in many churches built all over Europe, as well as in cathedrals. Glass production by blowing method was discovered by Syrian craftsmen. At first, it started by dipping an iron pipe about 1.5 meters long into the molten glass so that blowing could be done without mold. This revolutionary method has started the production of transparent thin glass. During this period, blown containers, jugs, bottles, jars, cups, goblets, bowls, plates and other tableware began to be used a lot. Such glass objects have become as common as pottery (Tavukçuoğlu, 2023: 8).

Figure 1. Glass production in ancient times (Karadağ v.d., 2019: 300)

Due to the increasing world population and limited resources, researchers are trying to use waste materials to ensure the recycling of some products when they make a new production. This cycle must be continued until the end of the life of the material. One of these waste materials is Glass. The importance of glass in recycling is great. Glass waste has the potential to be reused and create new products. Glass is the only substance that can be recycled 100% among the products we use. Glass is the only one that can be recycled 100%.

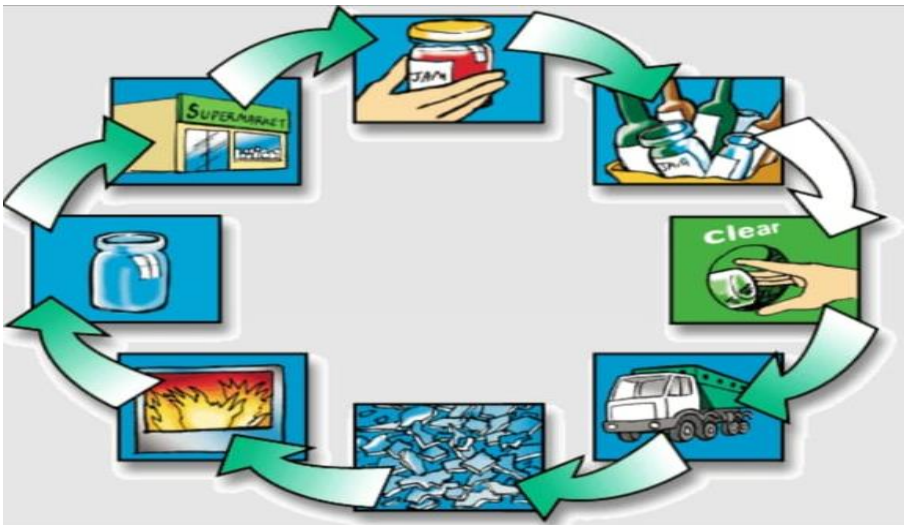

Figure 2. Environment
(https://cevre.bartin.edu.tr/haberler/gorsellerle-cevre-muhendisligi.html 11.07.2024, 15.12)

How glass is recycled; Glass materials, which are separated according to their colors and prepared for recycling in collection and separation facilities, are used in the production of 100% secondary raw materials. The process of melting and re-evaluating broken windows ensures that less energy is used than the actual process. The air and water pollution generated during the production of glass made by recycling is less than the production with raw materials.At least one out of every three glass packages we use is made of reclaimed glass. Waste glass bottles and jars are used in the production of glass packaging. Other types of glass are not included in this process due to the fact that the raw material they contain is different [URL-2].

Energy saved as a result of recycling a glass bottle is equivalent to the energy used by;

a 100 watt light bulb in 1 hour,
A computer in 25 minutes,
A TV in 20 minutes,
a washing machine in 10 minutes.

Decorative Waste Glass Art

Waste material is becoming increasingly important in today's conditions and the use of waste material is increasing to contribute to sustainability. For sustainability, consumers should be encouraged to use recycled materials in order to meet their requirements, without jeopardizing the needs of generations living today and those who will live in the future. As long as we continue to use the Use-Throw method, we will have created a world in which our natural resources will be depleted and a new one cannot be replaced with a large increase in environmental pollution.

Recycling, sustainability and natural science are concepts that have very important interrelated roles. Art has been one of the factors that has made awareness of many things that are important for the world, and recycling materials have been a unique opportunity for art.

Glass to be recycled for art and design has also taken its place among the materials that artists want to evaluate. Recycling glass has become an example of sustainability, and sustainability has a deeper meaning with the use of waste glass material in works of art.

The recycling works carried out in modern art are based on attracting attention, surprising and creating awareness on the audience. The project was prepared by the coordination of Yaşama Sevinci Special Education Vocational School (Turkey) based in Turkey and among its partners Karabuk University (Turkey), Giovani Per I'Europa (Italy) and Special Elementary School “Idnina” (Skopje – (The Republic of North Macedonia)), which was presented during the call for proposals for 2022 within the scope of the Erasmus+ Program activity, numbered 2022-1-TR01-KA210-VET-000080998 and within the scope of the project titled ”Recycling to Art", case studies were studied together with teachers, academics, artists and students, such as artists who have set their hearts decently on this work, in order to increase awareness. As an example of these studies;

Decorative Handmade Lantern

Waste materials used; waste cardboard, paper, newspaper, napkin, etc., waste glass jar, waste wire.

Auxiliary materials used: acrylic paint, water-based glue, hot silicone, ceramic pulp made of glue and starch.

Auxiliary tools used; utility knife, brush, pen, ruler, silicone gun, pliers.

Application; We cut the waste cartons 15x15, 13x13 and 10x10 cm square with the help of a utility knife and a ruler, and cut and remove the cardboard jar or glass bottle cut 13x13 cm so that it settles exactly in the middle point. we cut our cardboard to form a 15x13x4 cm long edge frame (Fig. 3).

Figure 3. Organizations

We place the jar so that the bottom and top are facing and glue the jar and the edges with the help of hot silicone. After the edge construction is completed, we cut our cardboard with a cross section of 10x10 cm so that it passes into the mouth part of the jar and glue it to the mouth part (Fig. 4).

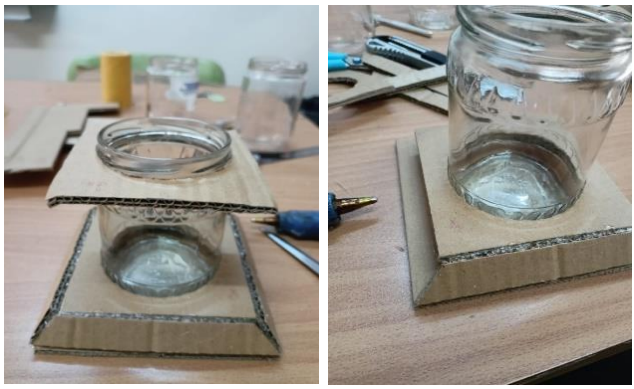

Figure 4. Organizations

Waste paper, newspaper, napkin, etc. we cut the materials into small pieces, mix ½ water with ½ water-based glue and glue the small pieces of paper we cut with the help of a brush to cover all sides of the cardboard except the jar. Then we leave our object to dry (Fig. 5).

Figure 5. Organizations

After the drying process is completed, after the desired shape is given to the ceramic paste made with a mixture of glue and starch, we glue it on the object, complete the decoration process, cut our waste wire with the help of pliers and attach it to the lid (Fig. 6).

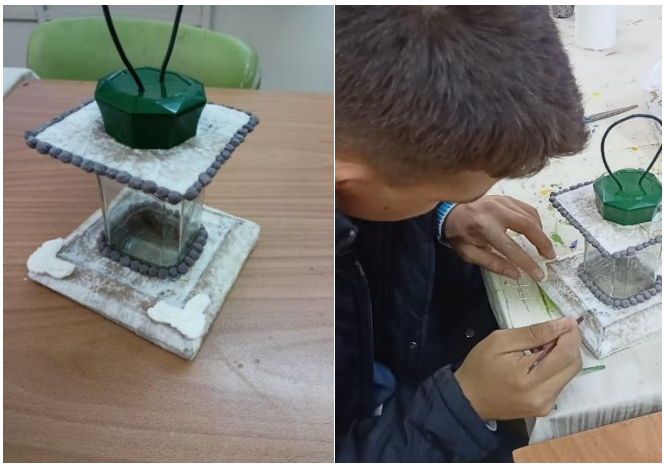

Figure 6. Organizations

We complete our decorative recycling lantern by painting with acrylic paint with the help of a brush in the desired colors and then discarding our varnish (Fig. 7-8).

Figure 7. Organizations

Figure 8. Organizations

Workshop and sample product within the scope of converting waste glass fruit juice bottles into art (Fig. 9).

Figure 10. Organizations

Figure 11. Organizations

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CHAPTER - 7

The Use of Metal Waste in the Recycling of Art
Use of Waste Metals in Decorative Art

Author:

Şerife EROĞLU YALÇIN

Teacher, Ministry of Education Karabük Yaşama Sevinci Special Education Vacational School, Handicraft Technology Teacher and Head of the Department, Karabük, Türkiye**.** serifeerogluyalcin@gmail.com

Burcu AYKOL ACAR

Teacher, Ministry of Education Karabük Yaşama Sevinci Special Education Vacational School,, Food technology Teacher and Head of the department, Karabük, Türkiye, burcuaykolacar@gmail.com

INTRODUCTION

According to the Waste Management Regulation published by the Ministry of Environment, Urbanism and Climate Change in 2015, waste: is defined as any substance or material that is discarded or left in the environment by its producer or actual owner, a natural or legal person, or that must be disposed of. Again, in the same regulation, recycling is defined as any recovery process in which waste is processed into products, materials or substances for the main purpose of use or other purposes, including the reprocessing of organic substances, except for energy recovery and re-processing of waste for use as fuel or filling. Accordingly, in the same regulation, recycling is a process that involves preparing waste for use for a useful purpose to replace substances used on the market or in a facility and covers the processes listed in -2/B (R4 Reclamation / recycling of metals and metal compounds) (Waste Management Regulation, 2015).

In this context; we can characterize waste as the name given to all kinds of substances that have expired, lost their function or are no longer desired and need to be removed from the living environment, which have a value when used in the right place by ensuring transformation.

The waste that nature cannot keep within itself has reached levels that threaten the ecological balance. However, people still continue to pollute nature, consciously or unconsciously (Yücel ve Morgil, 1998). For this reason, by creating recycling awareness, environmental awareness, natural resource conservation, prevention of global warming, climate change and environmental pollution reduction studies should be disseminated. A waste management system should be adopted to prevent environmental pollution and ensure efficient use of natural resources and energy conservation. Waste management is a process of great importance from an environmental and economic point of view. This process involvethe proper collection, transportation, processing and disposal of waste.

Figure 1. Waste management hierarchy (EPA, 2020)

When Figure-1 examined, the waste management hierarchy developed by the US Environmental Protection Agency (EPA) ranks waste disposal strategies from the most environmentally preferred to the least preferred. According to the hierarchy, reduction, reuse and recycling/composting are the methods that should be given priority in an effective waste management system. Preventing and reducing waste generation should be considered first in an ideal waste management; it is also the smartest option that reduces the amount of waste to be collected, transported and disposed of using fewer resources.

The most suitable option for waste that cannot be reduced or reused at source is recycling or composting, while energy recovery is considered a suitable method for waste that cannot be recycled or composted. Storage, on the other hand, should be considered as a method and final choice to be applied only for wastes that cannot be prevented, reduced, reused, recycled and obtained energy by burning [URL-1].

Instilling Recycling in Education and Turning it into Art

In order to make our world more livable, in order to protect, prevent the depletion and pollution of natural resources, a qualified environmental education should be provided in order to develop environmental awareness in individuals, to acquire sensitive, positive and permanent behaviors. This education should be given by teachers starting from the preschool period and reduced to everyday life with various activities and acquired as a behavior.

It has been stated that it is extremely important for teachers who will take an active role in qualified environmental education to develop sensitivity to maintaining the natural balance, to have knowledge of the subject, to develop attitudes and behaviors, taking into account the place of teachers who will take an active role in the processes of experiencing positive behavioral changes in this regard (Kahyaoğlu ve Kaya, 2012). The participation of individuals in recycling activities can be increased with the training to be provided in schools. But for this, first of all, schools need to adopt recycling and provide measures and equipment that will ensure recycling (Karatekin ve Çetinkaya, 2013). The school is an integrated place intertwined with the environment and society. It is an element that has dynamic effects on the environment and society in which it lives. Schools should provide recycling awareness and behavior to both students and the public (Karatekin ve Çetinkaya, 2013).

Collection methods and educational programs are being implemented in order to ensure the separate accumulation of recyclable packaging waste discarded in schools, collection and recycling by municipalities. For this purpose, waste bins are placed in schools and training is provided for students to separate waste correctly. Paper, plastic, glass, metal and battery waste bins are located in our schools and our students are informed. In addition, various activities can be carried out using these wastes in the courses and recycling of wastes can be provided.

Figure 1. School recycling corner belonging to the Zero Waste Project [URL-2]

When Figure-1 examined, a recycling corner has been established in all schools affiliated to the Ministry of National Education within the scope of the "Zero Waste Project" organized by the Ministry of Environment and Urbanization. The above picture was taken from the website of Istanbul Umraniye Arif Nihat Asya Elementary School. Thus, the project implemented continues to be effective in creating awareness.

It is the subject of many lessons in our schools and projects are carried out on this basis. Scientific and artistic products can be produced by using waste materials in the courses. Thus, the courses offer an ideal environment for developing students' creativity and evaluating waste materials. The transformation of waste materials into scientific and artistic products through efficient and creative activities also increases the environmental awareness of students. Science and art are a powerful tool for making people think, creating awareness and mobilizing them. Revealing the sensitivity of art to nature and the environment with works not only creates aesthetic value, but also creates social consciousness about sustainability and environmental protection. Works of science and art made from recycled metals serve this purpose by providing both environmental and economic benefits.

Metallic mines are extracted from nature as raw materials and then processed under favorable conditions to obtain pure metals or metal alloys that are ready for use.

Metals are indispensable materials of modern life with a wide variety of properties and wide areas of use. Metals have a wide range of uses thanks to their characteristics such as their unique brightness, high thermal and electrical conductivity, formability, chemical resistance, strength, ease of recycling. These superior properties and product range of metals have enabled it to have a wide range of uses and applications in industry and industry. Among the areas of use, we can count construction and deconstruction, transportation, automotive, electricity, electronics, medicine, health, household goods, energy and industry. In addition, metal recycling offers many advantages from an environmental and economic point of view and is widely applied in various industries.

Recycling of metals provides many important benefits, especially in terms of the environment and economy. Metal recycling provides a great energy saving compared to metal production from scratch. Thus, less harmful gases are released into the atmosphere and environmental and natural resource protection is ensured. By reducing the production costs in enterprises, a contribution is made to the socio-economic level in the employment process. The fact that metals can be used repeatedly without losing their properties in the recycling process makes this process very efficient. When we look at metal household waste, we can count canning cans, aluminum beverage cans, aluminum foils, oil and paste cans.

Photos and construction stages of products made from Art Recycling and Waste wire and cable wire: Decorative Handmade Life Tree

The project was prepared by the coordination of Yaşama Sevinci Special Education Vocational School (Turkey) based in Turkey and among its partners Karabuk University (Turkey), Giovani Per I'Europa (Italy) and Special Elementary School “Idnina” (Skopje – (The Republic of North Macedonia)), which was presented during the call for proposals for 2022 within the scope of the Erasmus+ Program activity, numbered 2022-1-TR01-

KA210-VET-000080998 and within the scope of the project titled ”Recycling to Art", some of the works carried out were provided by using waste metal. For example;

Pot making from canning box, ornament making from beverage box, painting from aluminum foil, jewelry making from waste wire, sculpture making from waste tin and wire, cutlery table, etc. such artistic works and the construction phase are included.

In the workshop of the Handicraft Technology department with the students of Yaşama Sevinci Special education Vocational School of, it is aimed to create recycling awareness on the students and the decorative handmade tree of life construction stage and photos, which is one of the artistic works made with recycling materials, are included.

Waste materials used; waste metal wire, waste cable wire and waste beads

Auxiliary materials used; scissors, ruler, pliers.

Application; We cut our waste metal wire with the help of 20 cm long pliers and make a circle shape and connect the junction by wrapping it with our waste cable wire as in Photo-1 and Photo-2.

Figure 1. Organizations

The waste cable wire is cut to 30 pieces with 15 cm long pliers with the help of a ruler and wrapped each wire 3 times, as shown in figure 2, so that each piece of wire is side by side with our circle wire, taking the exact middle point.

Figure 2. Organizations

After the installed waste cable wires are brought side by side, they are twisted in such a way that a tree root appearance is formed according to three or five requests. Then, the end parts are attached to the circle by attaching our waste beads as seen in Figure 3 in such a way as to give the appearance of flowers, leaves, fruits.

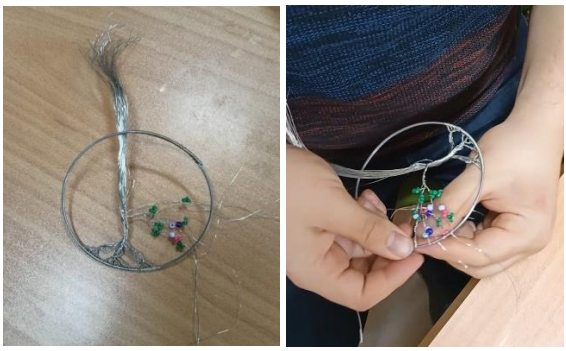

Figure 3. Organizations

The ends of the wires attached to the circle are cut with the help of pliers and compressed and hidden so that they do not sink into the hand, completing the handmade tree of life made from waste recycling. The finished form is as seen in Figure 4.

Figure 4. Organizations

Other works carried out using waste metal; within the scope of restoring waste metal to art, various artistic activities were carried out with the participation of scientists from important schools such as Yaşama Sevinci Special Education Vocational School (Turkey), Karabuk University (Turkey), Giovani Thu l'Europa (Italy) and Special Elementary School "Idnina" – Skopje (The Republic of North Macedonia). A recycling touch has been given to miniature toy art by producing a teapot figure from tin coke cans. In addition, some metal parts are put together to make frames, pen holders, flower pots, decorative Decals and souvenirs, etc. by creating products of such types, contributions have been made to the zero waste scope, thinking and imagination have been activated and awareness has been created.

Figure 5. Organizations

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CHAPTER - 8

The Use of Paper Waste in Recycling to Art Transformation of Waste Paper Into Decorative Art

Author:

Şerife EROĞLU YALÇIN

Teacher, Ministry of Education Karabük Yaşama Sevinci Special Education Vacational School, Handicraft Technology Teacher and Head of the Department, Karabük, Türkiye**.** serifeerogluyalcin@gmail.com

INTRODUCTION

Today, the world population is gradually increasing worldwide, but environmental pollution continues to increase, and in parallel, it is an inevitable fact that natural resources are decreasing to the same extentThus, the excessive unconscious use of natural resources also brings with it a number of problems. The most important among these problems is, of course, the destruction of the environment, Decontamination, and therefore, of course, the deterioration of the balance. These events appear to us today as environmental problems (Akman v.d., 2000: 10).

In this section, the positive studies to be obtained by evaluating waste paper under the name of recycling to art under the light of literature information are mentioned, and in the light of these studies, sample studies conducted in the Handicrafts section related to the transformation of paper into art are included.

The Transformation of Waste Paper into Art

As we all know, paper is an engineering marvel, mostly obtained from wood raw materials, used almost everywhere and in every sector from the past to the present.

When the literature is examined, it is seen that many definitions of paper have been made. According to the TDK, paper is defined as a dry, thin leaf made of various vegetable substances made into a pulp, used for writing, printing, wrapping something (TDK, 2024).

Although paper obtained from wood raw materials is considered the most advanced technological product in the world, it becomes waste after use, and the paper that becomes waste is processed in facilities related to this area and recycled.

In addition to raw materials such as wood, straw, cotton, reed, hessian, waste paper is also considered a secondary fiber and is reproduced by recycling, paper has an important place in paper production.

Since cellulose is already available in fiber form and ready-made in paper products that have become inert by completing their use, it can be

recovered much more simply and economically from woody and herbaceous vegetable (lignocellulosic) material without the need to produce cellulose by long and costly processes (pulping). Establishment and operation of recycling facilities in general;

• It can be done at much less cost,

• It can be operated with lower energy usage and operating costs,

• Production can be maintained by causing less damage to the environment,

• By evaluating waste paper, the solid waste problems of municipalities can be significantly reduced and a considerable added value is added to the national economy (Şahin, 2016: 31).

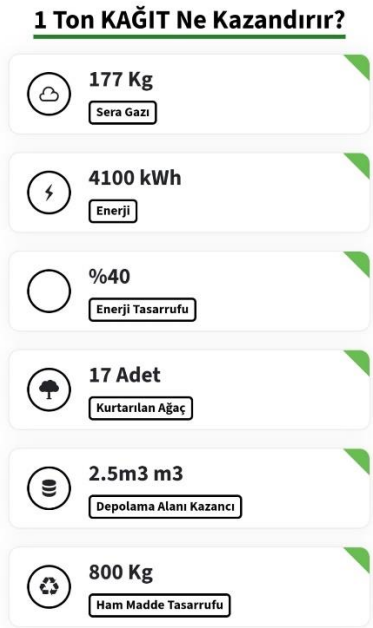

Figure 1. https://sifiratik.konya.bel.tr/wt/https---sifiratik-gov-tr-kagit-atik 2024

As can be understood from Figure – 1, according to the data obtained from the website of Konya Municipality, it shows the environmental pollution (greenhouse gas), energy and energy savings of 1 ton of paper, the number of trees saved, storage space gain, raw material savings numerically.

In terms of making people aware of recycling in waste paper, it is more from the source of recyclable waste for making public spots and projects, creating a healthy and efficient recycling system, i.e. in residential buildings, educational institutions, public institutions, hotels, workplaces, etc. it must be collected separately from the garbage.

In this context, the strategy we have implemented in the art recycling project is to recycle the waste generated by recycling in Handicrafts until the end of its useful life without applying a different process other than collection, separation and cleaning, with artistic activities aimed at creating various ornaments, souvenirs and decorative products, not every waste is waste, and it is aimed to turn them into a work of art with our imagination.

The project was prepared by the coordination of Yaşama Sevinci Special Education Vocational School (Turkey) based in Turkey and among its partners Karabuk University (Turkey), Giovani Per I'Europa (Italy) and Special Elementary School “Idnina” (Skopje – (The Republic of North Macedonia)), which was presented during the call for proposals for 2022 within the scope of the Erasmus+ Program activity, numbered 2022-1-TR01-KA210-VET-000080998 and within the scope of the project titled ”Recycling to Art", waste paper is not just waste, in order to create awareness and guide people, the works of art produced with academics, teachers, artists and special education students in this department are aimed at creating an impact on humanity and attracting attention, the products made have been video recorded and photographed.

Photos of products made from Waste paper and stages of construction

Handmade Decorative Key Hanger

In this section, it is aimed to create recycling awareness on students in the workshop of Yaşama Sevinci Specia Education Vocational School of and the Handicraft Technology department, and the construction phase and photos of

the decorative key hanger, which is one of the artistic works made with recycling materials, are included (Fig. 1).

Figure 1. Organizations

Waste materials used; waste cardboard, paper, newspaper, napkin, cardboard egg box, waste wire, waste flakes and beads, waste rope.

Auxiliary materials used; acrylic paint, water-based glue, hot silicone, glue, adhesive, utility knife, brush, pencil, ruler, silicone gun, pliers.

Application; 2 pieces of 15x20 cm rectangular cardboard are cut from the waste cartons and glued together as shown in Photo-1 with the help of glue or hot silicone on top of each other.

Figure 1:

In order to give an antique door shape on the cut cardboard, another 10x15cm rectangular cardboard is cut and the corners, two corners of which correspond to 10 cm, are cut in an oval shape as shown in Figure 2.

Figure 2. Organizations

Figure 2:

Cut the antique door form into five pieces with the help of a ruler and a utility knife at 2 cm intervals, paste them on the previously prepared 15x20 cm cardboard, cut two more pieces of 10x1 cm long cardboard and glue them parallel to the door form, as seen in Photo-3. Scraps of cardboard cut into small pieces are glued randomly to fill the empty areas on the edge.

Figure 3. Organizations

Figure 3:

½ water-based glue and ½ water are mixed homogeneously in a container. The cardboard form that we create with the help of the resulting mixture brush is covered with waste paper or napkin in such a way that there are no gaps and left to dry. After drying, the obtained object is painted with acrylic paint, as in Figure 4.

Figure 4. Organizations

Figure 4:

After the painting process is completed, in order to give the edge frame shape to our antique door, the glue mixture dough obtained from the previously prepared waste paper is pasted into thin strips with the help of tweezers, covering the edge corners, painted and left to dry. The dried object is given an aged appearance with the help of acrylic gilding paint. See figure 5.

Figure 5. Organizations

Figure 5:

After the aging painting of the key hanger is completed, the waste rope, flake beads, metal parts, etc. it is decorated with the desired way. See Figure 6.

Figure 6. Organizations

Figure 6:

In order to make the hanging devices of the key hanger, the product is completed by cutting 6 cm long rods from the waste wires with the help of pliers and curling the ends in the half ring position with the help of pliers and gluing them to the lower part of our hanger. See Figure 7.

Figure 7. Organizations

Figure 7:

For the hanger of the product to be hung on the wall, the waste rope is turned into an auger and the product is completed by throwing varnish glued from the back with the help of warm silicone. See Figure 8.

Figure 8. Organizations

Figure 8:

The project was prepared by the coordination of Yaşama Sevinci Special Education Vocational School (Turkey) based in Turkey and among its partners Karabuk University (Turkey), Giovani Per I'Europa (Italy) and Special Elementary School “Idnina” (Skopje – (The Republic of North Macedonia)), which was presented during the call for proposals for 2022 within the scope of the Erasmus+ Program activity, numbered 2022-1-TR01-KA210-VET-000080998 and within the scope of the project titled ”Recycling to Art", photos of other products made from waste paper;

Figure 9. Organizations

Figure 9:

A study conducted by turning waste newsprint and egg boxes into dough and giving a pumpkin form around a balloon. See Figure 10-11.

Figure 10. Organizations, Decorative Products Made of Waste Paper and Newspapers

Figure 11. Examples of Decorative Paintings Made From Waste Cardboard and Paper

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YAŞAMA SEVİNCİ ÖZEL EĞİTİM MESLEK OKULU

KARABÜK ÜNİVERSİTESİ

UNIVERSITY OF KARABUK
TÜRKİYE

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