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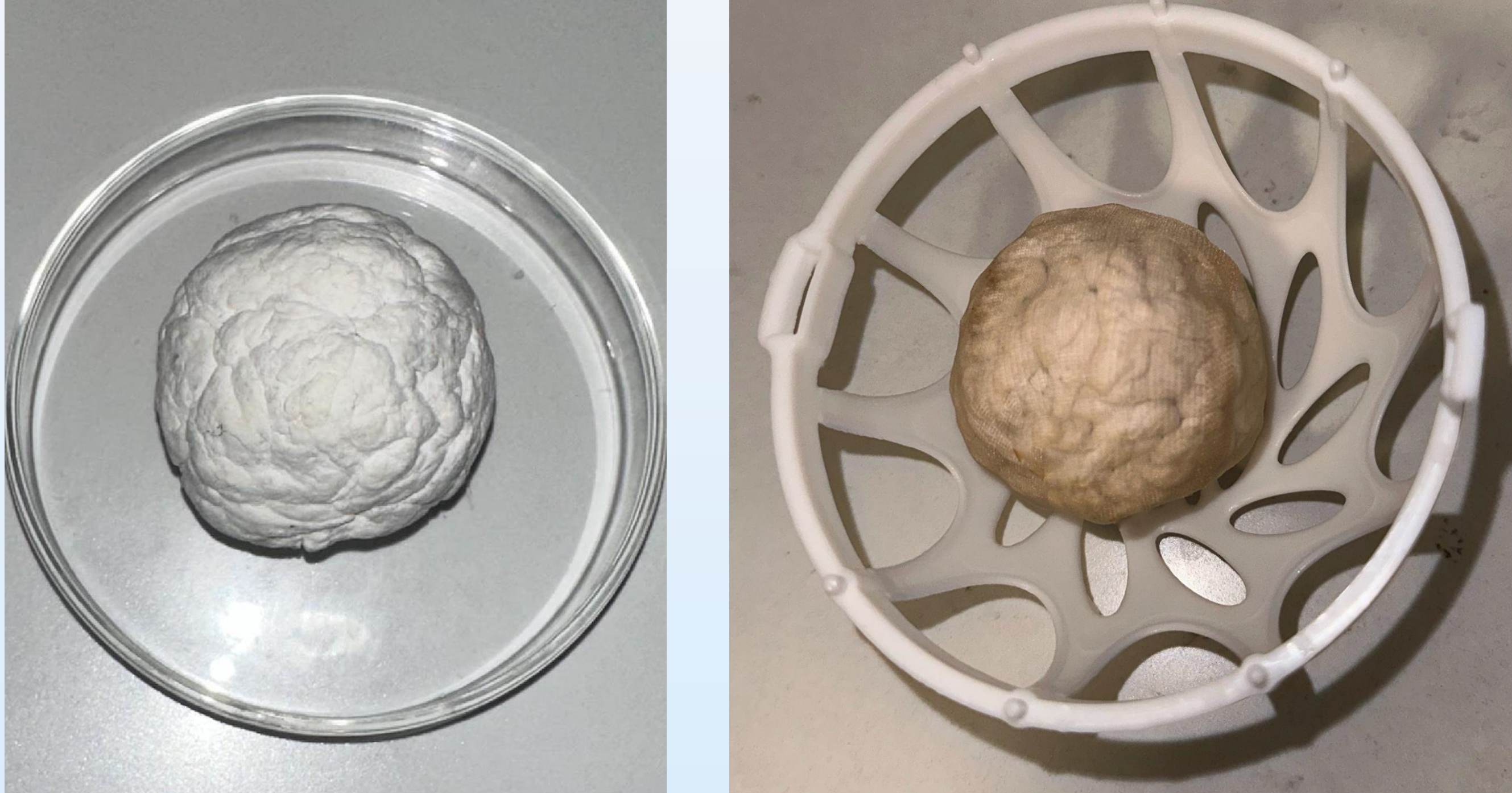
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### Abstract

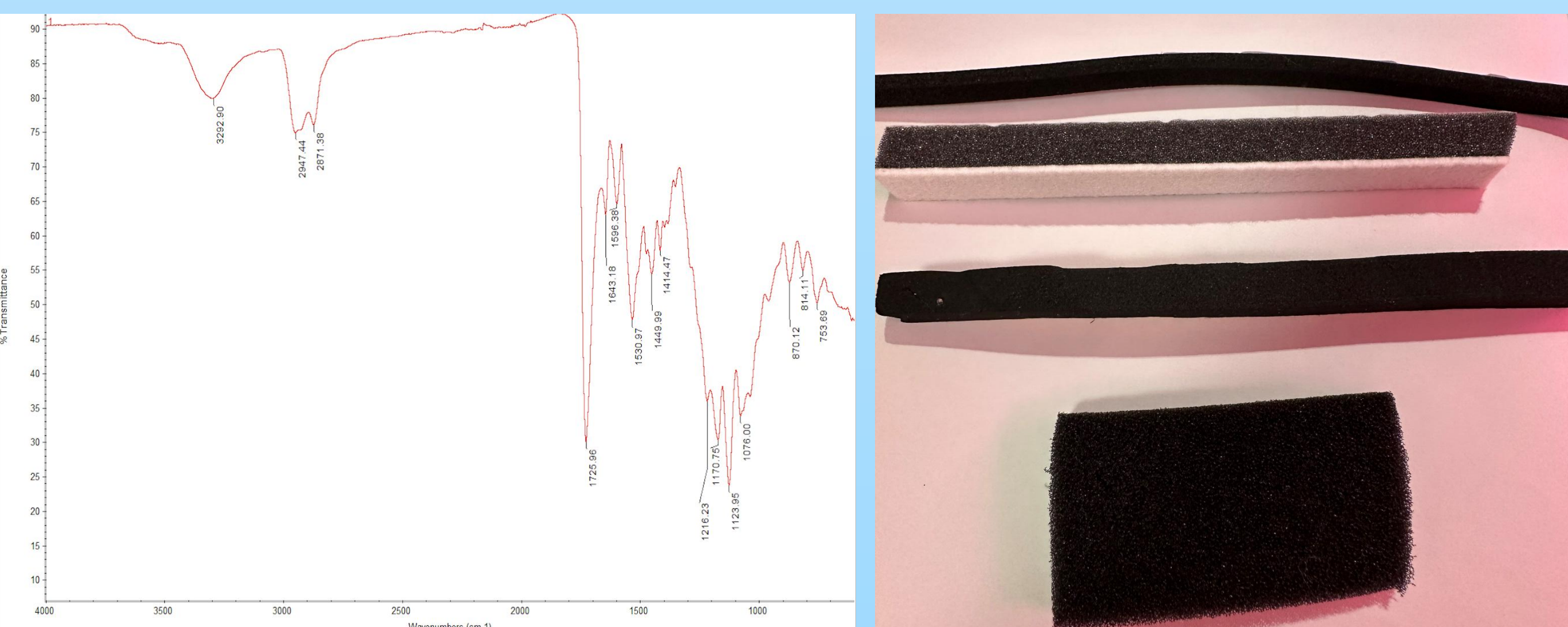


The evaluation of dryer balls manufactured using waste materials from Arçelik's dryer machine factory is the focus of this project. The moisture retention capabilities and their impact on drying times are assessed. Market research was conducted to examine the potential of these balls in the industry. The environmental impact of the dryer balls throughout their life cycle stages, including raw material sourcing, production, use, and disposal, is analyzed using the Life Cycle Assessment (LCA) methodology. Factors such as resource use, energy consumption, emissions, and waste generation are quantitatively assessed to promote environmentally sustainable products. The successful production of high-quality inner balls using readily available perforated laundry balls has led to the consideration of incorporating waste materials into the outer shell for future applications. Future research and development will explore the feasibility of this approach and its potential for positive LCA results. The project highlights opportunities for sustainable innovation and the adoption of eco-friendly practices by utilizing waste materials from Arçelik's dryer machine factory in the production of dryer balls.

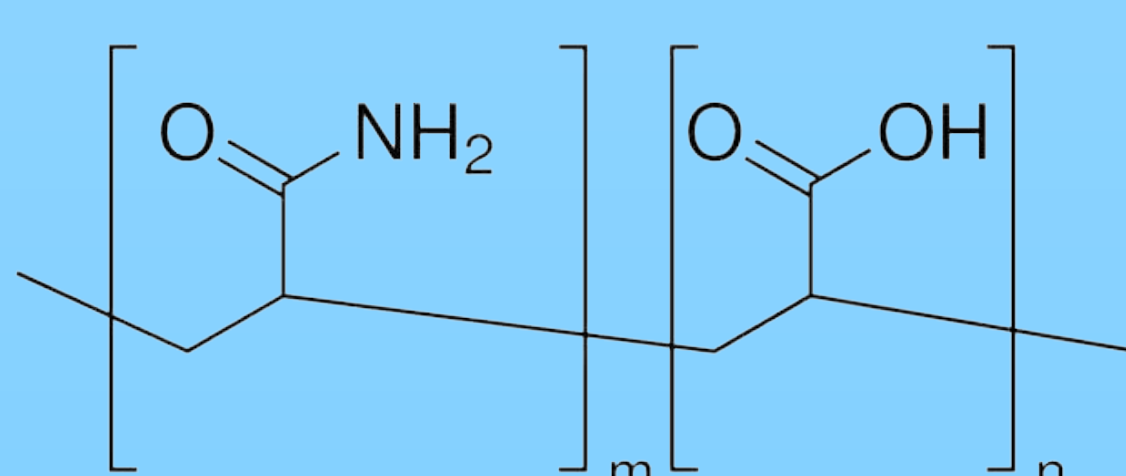
### Objectives

The market research focused on evaluating different brands and qualities of dryer balls. The study aimed to investigate the moisture retention values of various balls and their impact on drying times. As part of this research, Arçelik's findings were utilized. Additionally, the waste materials of Arçelik such as ABS, PP, EPDM, and copper wires, were examined to determine the most suitable options for future production. The analysis also involved assessing the contribution of the produced dryer balls to drying times. By comparing the humidity ratios in the laundry before and after drying, the effect of the balls on drying time was investigated. Furthermore, the research aimed to determine the energy-saving potential of the produced balls through their moisture retention capabilities. As the moisture retention feature improves, the drying time is extended, resulting in energy savings. This aspect was thoroughly investigated to understand how much energy can be saved with the use of these dryer balls.

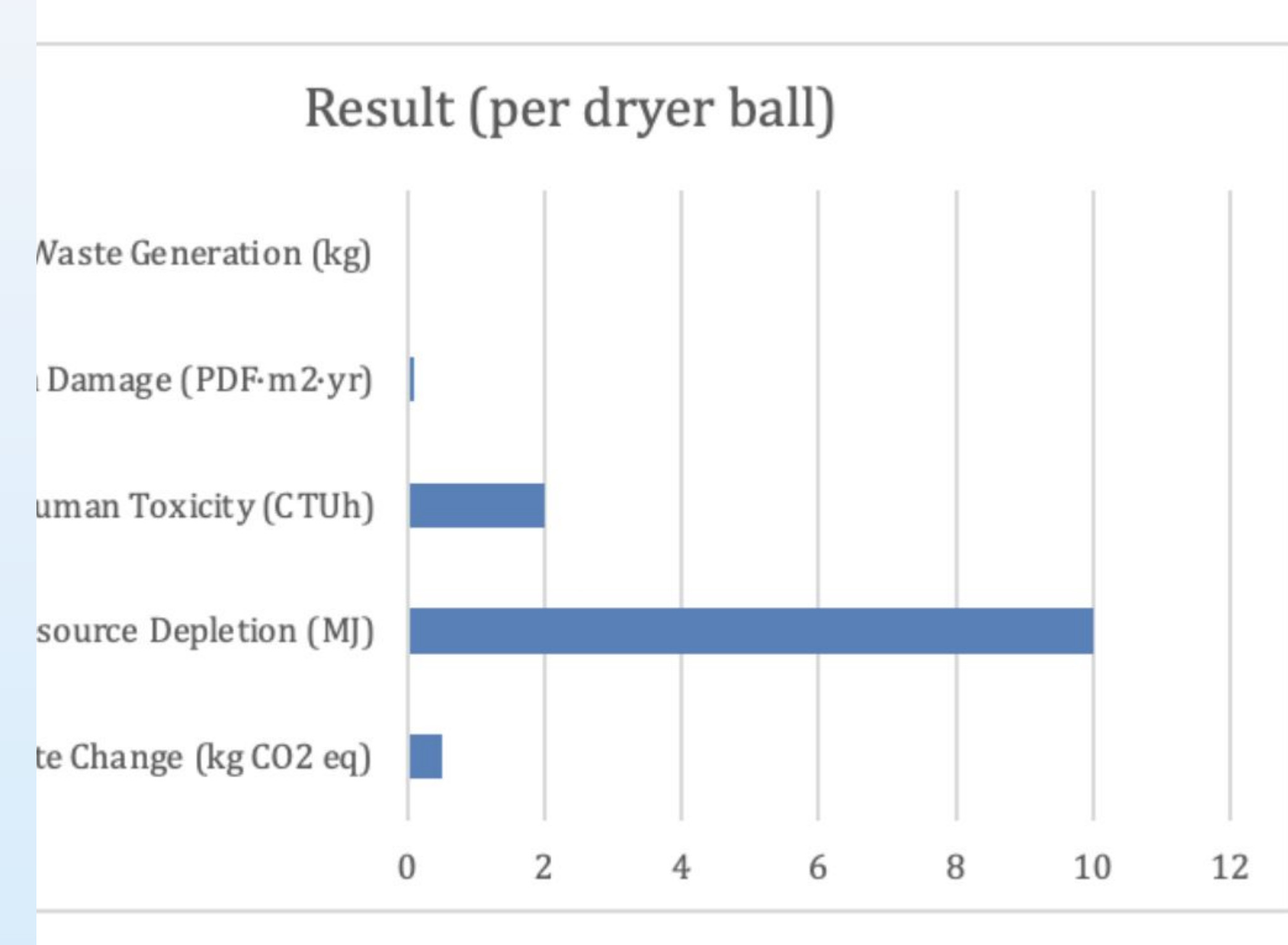
### Project Details



In the project, market research was first conducted and the test results of Arçelik in the past were examined. The lists and characteristics of the wastes in Arçelik's factories were determined. During the factory visit, samples were taken from the wastes and FTIR analyses were performed in the laboratory of our university. The result of FTIR is the characterization result of the sponge material at the bottom. When the chemical bonding peaks were looked at and searched in the library, a high percentage of material was polyester based PU. Characterization tests were performed for all 4 wastes in the image and the results were; polyester based PU, polyether urethane, poly(ethylene-co-vinyl acetate and CLAY. Initially, a ball design was determined from waste for the outer ball, but because the time needed for mold design was not available, perforated outer white shells with laundry balls were provided for the outer ball. By focusing on the inner ball design, waste lint from Arçelik's tests was used. These wastes were combined with SAP. SAP, which stands for Super Absorbent Polymer, was used in this project to refer to the acrylamide-co-acrylic acid copolymer, obtained through the polymerization of acrylic acid and acrylamide compounds.



### LCA



Using the Life Cycle Assessment (LCA) methodology for the dryer ball project, the environmental impact of the product is analyzed throughout its entire life cycle. The stages of the dryer ball such as the supply of raw materials, production, use and waste disposal are examined. The LCA methodology quantitatively assesses the environmental impacts of factors such as resource use, energy consumption, emissions and waste generation. This approach promotes the use of recycled materials, supporting sustainability improvements such as energy saving methods and waste reduction strategies. LCA facilitates informed decision-making about the selection of environmentally sustainable products. In the initial phase of the dryer ball project, the project objectives, stakeholders and boundaries are determined.

### Test Results

TEKSTİL LABORATUVARI TEST TAKİP FORMU															
CEVİRİM	PROGRAM	KURU YÖK AĞIRLIĞI (gr)	K. ÖNCESİ AĞIRLIK (gr)	KURUTMA ÖNCESİ NEM ORANI (%)	K. SONRASI AĞIRLIK (gr)	KURUTMA SONRASI NEM ORANI (%)	TOPLANAN SU (gr)	KURU VERİM (%)	ORTA SICAKLIK (°C)	SÜRE (D)	SİRE (SA)	LOG NO	ENERJİ (MJ/ENERJİ)	YÖK RİPİ	
1	P.ECO	2.000	3005	50	2.021	1,05	593	60	24	230	70	81	708	836	M70
2	P.ECO	2.000	3001	50	2.031	1,55	795	82	24	230	60	82	618	769	

HOMOJENİTE SONUÇLARI															
1. TEST, TOPLU							2. TEST, TOPSUZ								
YÖK ADI	NO	KURU	K. ÖNCESİ	ÖNCE	K. SONU	SONRA	NEMLİ YERLER	YÖK ADI	NO	KURU	K. ÖNCESİ	ÖNCE	K. SONU	SONRA	NEMLİ YERLER
Kot Pantolon	ZM_1	539	740	37,3%	536	-0,6%		Kot Pantolon	ZM_1	539	740	39,0%	545	1,1%	
Çocuk Kot Pantolon	ZM_2	228	320	40,4%	230	0,9%		Çocuk Kot Pantolon	ZM_2	228	316	38,6%	227	-0,4%	
Pamuklu Gömlek	ZM_3	220	334	51,8%	222	-0,9%		Pamuklu Gömlek	ZM_3	220	341	55,0%	229	2,2%	
Pamuklu Havlu	ZM_4	201	336	67,2%	242	20,4%	KEMAR KISMI	Pamuklu Havlu	ZM_4	201	345	71,6%	239	18,9%	KEMAR, ORTA KISMI
Çarşaf	ZM_5	882	912	10,3%	887	-0,6%		Çarşaf	ZM_5	882	891	55,1%	876	-0,1%	
Yaşak Kışık	ZM_6	83	136	62,7%	81	-2,4%		Yaşak Kışık	ZM_6	83	136	63,9%	81	-0,4%	
Yaşak Kışık	ZM_7	87	134	54,0%	85	-2,3%		Yaşak Kışık	ZM_7	87	137	57,5%	86	-1,1%	
El Havlusu	ZM_8	60	84	56,7%	58	-3,3%		El Havlusu	ZM_8	60	85	43,3%	58	-3,0%	

### Conclusion

The initial design for the exterior cover of the product was deferred due to time constraints and the complex mold creation process. Instead, the focus shifted to the inner ball component, which was sourced from readily available perforated laundry balls. This decision aimed to streamline production and ensure efficient manufacturing. If the Life Cycle Assessment (LCA) results are favorable, the product could be ready for mass production and sale, contributing to sustainable practices in the market. The potential for a product with positive LCA results and the use of waste materials in the outer shell present opportunities for sustainable innovation and promoting eco-friendly practices. When we look at the results of the dryer ball, it is seen that efficiency is achieved in some laundry, these are cotton-containing products such as cotton shirts and cotton towels. When we compare the 1st and 2nd dryer balls, it is seen that the second ball retains more moisture and reduces the drying time. As a result of the tests, it was concluded that the balls should be developed and that it can work especially with cotton fabrics.

### References

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