BEYAZ KUM MİDYESİ ve DENİZ KESTANESİ KABUK ATIKLARININ SERAMİK ÜRETİMİNDE DEĞERLENDİRİLMESİ

UTILISATION OF CLAMS AND SEA URCHIN SHELL WASTES IN THE CERAMIC INDUSTRY*

Ergün ARDA[1]
Sezginer TUNÇER[2]

Bu çalışmada, Türkiye canlı deniz kaynaklarından Beyaz Kum Midyesi *(Cik Cik)*, (*Chamelia gallina*) ve Deniz Kestanesi (*Parocentrotus lividus*) atık deniz kabuklarının seramik sanayiinde kullanımı araştırılmıştır. Ekonomik değeri yüksek olan bu deniz canlıları insan gıdası olarak çiğ ya da pişmiş tüketilmekte ancak, kabukları değerlendirilmemektedir. Çevresel açıdan bir atık olarak bilinen bu kabukların seramik sanayiinde değerlendirilmesi bir çevresel dönüşümün önemli bir parçası olabilir mi? Bu bağlamda Çanakkale'de mevcut Su Ürünleri işleme tesislerinden atık ve deniz kıyılarından toplanan kabuklar ile laboratuvar ve atölye ortamlarında (uygulamalı) çalışmalar yapılmıştır. Kırmızı ve beyaz hazır reçete kil bünyeye belli oranlarda granül haldeki deniz kabukları ilave edilmiş ve yeni bünyeler elde edilmiştir. Geleneksel yöntemlerle şekillendirilen yeni bünyelerden çanak formları üretilmiş, seramik fırınlarında 1000°C'de pişirilmiştir ancak, amacın dışında beklenmedik bir sonuca varılmıştır. Çalışmaların bulguların ışığında devam etmesi önerilirken, sanatsal amaç için kullanılacak fikirlere de ulaşılmıştır.

Anahtar Kelimeler: Beyaz Kum Midyesi, Geri Dönüşüm, Seramik

ABSTRACT

In this study, it is researched that the use of the residues of white sand clam, clam (*Chamelia gallina*) and sea-urchin (*Parocentrotus lividus*) in ceramic industry. These sea creatures with high economic value can be consumed raw or cooked, but their shells are not utilized. They are all disposed. Could these shells, which are environmentally known as waste, in the ceramic industry be an important part of the environmental recycling? In this context, applied studies were conducted in laboratories and workshop environments with waste and shells collected from the sea coasts from existing Fisheries processing facilities in Çanakkale. Red and white ready-made recipe clay shells in granular form were added to the structure in certain proportions and new structures were obtained. These structures were used to make bowls by using the traditional ways. Bowl forms were produced from the new bodies shaped by traditional methods, they were fired in ceramic furnaces at 1000 °C, but an unexpected result was reached. While it is recommended that the studies continue in the light of the findings, the ideas to be used for artistic purposes have also been reached.

Keywords: White Sand Clam, Recycling, Ceramic

[1] Dr. Öğr. Üyesi, Ergün ARDA, Çanakkale Onsekiz Mart University, Faculty of Fine& Arts, Department of Ceramics and Glass, ergunarda@comu.edu.tr *ORCID No:* 0000-0002-3381-8162
[2]Prof. Dr. Serzginer TUNÇER, Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, Fisheries Basic Sciences, stuncer@comu.edu.tr
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INTRODUCTION

The use of sea shells around Anatolia and the Mediterranean has been known since Paleolithic Age. Its widespread use coincides with the Late Glacial and early Holocene period. It was used extensively until the Neolithic and Chalcolithic periods[CITATION Erg19 \l 1055]. As a result of the excavations of Troia Ruins in Çanakkale, it was determined that sea shells dating back to 2500 years were used in ceramics. White Sand Clam *(Cik Cik)* in the Black Sea Region and Marmara Sea coast are distributed extensively in the 0-20 meters depth. It is seen in Selimpaşa, Silivri, Tekirdağ, Kumbağ, Gelibolu (Gallipoli), Çanakkale, Musoke and Gemlik Gulf in the Marmara Sea and Kocaeli (Kefken), Sakarya (Karasu and Kocaali), Düzce (Akçakoca) and Kastamonu, Sinop and Samsun coasts in the Western Black Sea Region [CITATION Zaf19 \l 1055]. There are more than 800 different species of sea urchins included in the group of Echinodea *(skinned thorns*). In Turkey, there are only 17 species of sea urchins. Only 20 of the species in the world are consumed as food. *Parocentrotus lividus* and *Chamelia gallina* species along the Mediterranean and Aegean coasts of Turkish borders are seen very often. *Parocentrotus lividus* is the most preferred species for food[CITATION Sez \l 1055]. In this study, it is aimed to evaluate the shells of White Sand Clam and Sea Urchin, which are considered as important waste, by adding them into the clay body (structure) used in ceramic production. For this purpose, new suggestions were developed during the study process. The common effect of the study is that the data obtained from the study would provide findings for the future studies for the public and private institutions and universities.



Şekil 1, A- Toria III Period, some used sea shells. B- White Sand Clam, *Chamelea gallina (cik cik),* (httpswww.milliyet.com.tryerel-haberlerduzcebeyaz-kum-midyesi-av-yasagi-basladi-10760554). C- Sea Urchin (Parocentrotus lividus) general view[CITATION Sez \l 1055].

FINDINGS AND COMMENTS

White Sand Clam, *(Cik Cik), Chamelia gallina*

White sand clam, which scientific name is *Chamelia gallina*, in English; Stripped Venus, in French; Petite praire, in Italian; It is called Vongola and Chirla in Spanish. *Chamelia gallina* which has a wide distribution area in the world; It is distributed in the coasts of Spain, France and Tunisia, in the Adriatic Sea and in the coastal sandy strip of the Atlantic Ocean covering the North African coasts from Norway[CITATION Tür \l 1055]. The white sand clam species are in different sizes. Its average length is 2.20 cm, its width is 2.5 cm and its height is 1.1 cm.

Sea Urchin *(Parocentrotus lividus)*

It is this species that has many synonyms and is most commonly known as Paracentrotus lividus. Its skin is thorny and colloquially known as black thorn or stone chestnut. Sea Urchin can be found widely both in Turkish coasts and World Sea coasts[CITATION Ayş14 \l 1055]. Its diameter is approximately 7.1 cm. The main body of sea urchins and thorns are composed of MgxCa1-xCO3 (magnesium calcium carbonate). Besides, there are elements such as Na, K, Fe, Sr, Ba, Si, Al, P, S and Cl in its structure[CITATION Den12 \l 1055]. In general, the main ingredient of sea urchin shell is calcite (calcium carbonate) and the reason is due to the abundance of calcium in sea waters [CITATION Tüb20 \l 1055]. Calcium carbonate has similar properties with other carbonate types and when it is exceeded 850 ° C, it releases calcium carbonate and carbon dioxide. $CaCO_3 \rightarrow CaO + CO_2$.

Clay and Ceramic

Ceramics is traditionally defined as the science and technology of firing the compositions of non-organic raw materials which requires shaping with various methods, by glazing or not, in order to harden and gain durability. Ceramic raw materials are divided into two groups; loamy and without loam. The raw material that can be kneaded with water, can be easily shaped and maintains the shape given when it is dried is defined as the loamy ceramic raw material[CITATION Ate89 \l 1055]. Clays are fine-grained sediments with a grain size less than 0.02 mm; earthy, a mineral that increases plasticity when a certain amount of water is added and has a high content of alumina and silica. Clays are generally formed from the weathering of feldspars or the dissolution of volcanic rocks under certain conditions[CITATION UMa15 \l 1055].

LABORATORY AND WORKSHOP

The collected White Sand Clam and Sea Urchin shells were cleaned of organic residues in them and collected in separate containers. The dehumidification of the sea shells was carried out by drying in an oven for 12 hours at 105 ° C. The porcelain was ground in mortars, the diameters were stretched to 500-1500 microns and the grain size was reduced to 1000 microns and below by passing through analysis sieves. (Figure 2)



Figure 2, A- Sea shells in granules in jars. B-Detail. (Photos by Melis YILMAZ)

Micronized and classified sea shells were brought to the applied ceramics workshop of Çanakkale Onsekiz Mart University, Faculty of Fine Arts, Ceramics and Glass Department. In the ceramics workshop, these sea shells were added to ready-made red and white clay in certain proportions. White clay body is defined as "white ceramic casting clay". This clay is fluid and its density is on average 50. The weight of white casting clay in plastic mug is 1700 gr. At this weight, 5 white casting sludges were prepared, 200 g, 300 g, 400 g, 500 g and finally 600 g of *Chamelia gallina* were added to each mug respectively. It was mixed by hand until it became homogeneous (Figure 3).



Figure 3, Addition of white sand clam (Chamelea gallina) and sea urchin *(Parocentrotus lividus)* into white and red clay body. (Photos by Melis YILMAZ)

After the shells and bodies are mixed by hand homogeneously, the bodies are poured on plaster plates. In this way, excess water was removed and kneaded by hand, it was made ready to be shaped in the potter's wheel. (Figure 3, 4).



Figure 4, The stages of evaporation of excess water and kneading on the plaster plate after adding the shell granules to the white clay. (Photos by Melis YILMAZ)

In addition to mixing the shell granules with the white body in certain proportions, red pottery clay was mixed with sea shells and red bodies were also prepared. (Figure 5).

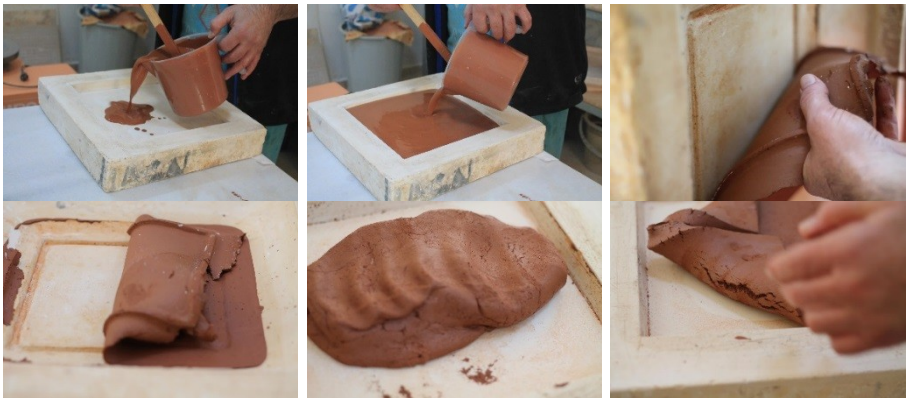


Figure 5, Steps of evaporation of excess water and kneading on the gypsum plate after adding the shell granules to the red mud. (Photos by Melis YILMAZ)

Appropximately within an hour, it has reached the appropriate plastic consistency to be shaped into both the white and red body. The rates involved in each body have been carefully noted. After this stage, shaping could be performed on the potter's wheel. After the clays are kneaded, Cik Cik and Sea Urchin shells can be seen in red and white clay bodies. Chamotte clay has a dispersion composition and the distribution of Sea shells granules that can be seen in the clay body is homogeneous. In the potter's wheel, which is a traditional shaping method, firstly, white clay bowl forms are shaped. Their height is 15 cm on average, their mouth diameter is 16 cm and their base diameter is 8 cm. 5 bowl forms were formed from white bodies prepared in five different proportions (11.7, 17.6, 23.5, 29.4 and 35.3). Likewise, bowl forms were produced with bodies prepared in 5 different proportions (11.7, 17.6, 23.5, 29.4 and 35.3%) and in the same proportions with red clay and sea shells. (Figure 6).



Figure 6, Red and white clay bodies were kneaded on a plasterboard and formed to be shaped in the potter's wheel. (Photos by Melis YILMAZ)





Figure 7, The shaping stages of red and white clay bodies on potter's wheel. (Photos by Melis YILMAZ)



Figure 8, The excessive addition of sea shells in red and white clay made shaping difficult. (Photos by Melis YILMAZ).

Difficulties have been experienced in the shaping of the sea shell granules, which are incorporated into the white and red body at 29.4% and 35.3%, in the potter's wheel. The high ratios have reduced the plasticity of the body and consequently; tears and splitting occurred during shaping. After this stage, the bowl forms containing sea shells were left to dry at room temperature (20 ° C). Seven days later, all samples were placed in a ceramic kiln and fired. (At 1000 ° C and 8 hours).



Figure 9, View after firing at 1000°C. (Photograph by Ergün ARDA)

All products were taken from the ceramic furnace and placed on the table in the office room in order to preserve. It was observed for 7 days in an environment with room temperature (22-25 ° C) and photographs were taken. After this process, surprisingly and unexpectedly, cracks and deformations began first in the body of the two white bowls and then in the red bowl forms. This deformation process did not develop suddenly, but occurred slowly. (Figure 10).



Figure 10, The view of the fired products dispersed at room temperature after one week. (Photos by Ergün ARDA).

The process shown in picture 11 is the process close to the end. The bowl forms have completely destroyed themselves due to the absorption of room moisture by the sea shells within. Although the bodies were fired and hardened at 1000 ° C and gained strength, they were flaky. There were no standing pieces left from the bowls and they completely turned into powder or granules. This is not the case with ceramic material.



Picture 11, Distortion images of bowls made of white and red Cik Cik and Sea Urchin, biscuit fired. (Photos by Ergün ARDA).

CONCLUSION AND RECOMMENDATIONS

While it was aimed to evaluate the shells of White Sand Clam and Sea Urchin within the clay bodies used in ceramic production, an unexpected result was encountered in this first study. Ceramic is a material that is formed by hardening at high degrees by heat treatment, and it was an unexpected result that the bodies containing sea shells fired at 1000 ° C began to dissolve after a week after firing, and completely destroyed in the process of being kept at room temperature. So why have fired bodies turned into powder? Calcium oxide was released when sea shells containing calcium carbonate were fired at low temperatures. Terracotta forms kept at room temperature and converted to calcium hydroxide by absorbing the humidity of the room temperature. It is this process that causes the forms to crumble or break up. The closest comment to this strong probability is as follows. Calcium carbonate (CaCO3) rapidly converts to calcium oxide (CaO) in the range of 750-850 ° C. Calcined calcium oxide is very porous, it deforms by absorbing moisture in the air and turns into calcium hydroxide (Ca (OH) 2)[CITATION Ray77 \l 1055]. The combination of calcium with water and the high content of calcium in the ceramic body caused the body to break down in a short time. The firing time of the new shellclay body, which was obtained by incorporating the clay bodies, was 8 hours and the cooling time of the oven was 8 hours. The new body was fired at 1000 ° C, but it is understood from the flake dispersion of the body that the firing degree, duration of the calcium carbonate body, the grain size of the calcium carbonate particles, whether they were calcined, and the density within the body should be well determined and the experiences should be repeated. The reason for the disintegration of the ceramic bowls is thought to be due to the fact that they were fired at a lower temperature than they should have been fired. For this reason, the body prepared by mixing with the shell granules at a certain percentage should be experienced in firing above 1000 ° C. Especially, it should be tried at 1100-1150 ° C intervals or calcined and added to the clay structure again. It was concluded that it would be appropriate to lower the percentage (10%) of the White Sand Clam and Sea Urchin shells added to the white and red clay bodies. It would be appropriate to reduce the granulated size of sea shells, which are 1000-1500 microns, to 100-500 microns in order to facilitate shaping. While working on the potter's wheel, it has been determined that 1000-1500 micron grain sizes are suitable for hand shaping, but the shells have been damaged during manual shaping as a result of the increase of 29.4% and 35.3% added into the body. During the studies, it has been observed that when sea shells were added to the body of white ceramic clays in certain proportions, the clay bodies became whiter. Apart from the efforts to recycle these two types of sea shells, which are in waste state, and to use them for the industrial purposes; the process of deformation and destruction of the fired ceramic body by the shell granules has led to new ideas which can be used in artistic work/s.

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Kaynakça

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