# Utilization of Sandy Clay "Kosarno" for other Raw Materials Production

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ABSTRACT: The paper shows following: the derivation procedure, material balance and the results of physical and chemical qualities of the quartz, quartz-feldspar sand and clay concentrate.
Using the procedure of moist sorting we can get the concentrate of: quartz (92,6% SİO2), quartz-feldspath sand (64,5% quartz, 25,6% feldspar, 8,5% mica) and clay (62% kaolin, 22,3% quartz and 10,35% microklin). The kaolin has been concentrated in the class -0.063 mm, the feldspar in the class -0.8+0.09 mm, and most of all in the class -0.09+0.063mm. The type of the clay is ball clay, chemical composition (%): S1O2 52.02, AI2O3 27.78, $Fe_20_3$ 2.82, CaO 0.65, MgO 0.54, $K_20$ 1.75, $Na_20$ 0.2 and L.O.I. 14.06 of great plasticity, good workable, and sensitive to drying.

## 1. INTRODUCTION

There are several kinds of quality raw materials; kaolin, clay, feldspar and quartz sand which have been used individually for the production of the sanitary ware, porcelain and the tiles. Depending of their own physical and chemical qualities they can be mixed in an appropriate relation to reach the necessary physical, chemical and mechanical attributes of the final product. As a replacement for the pure feldspar and quartz sand it can be used quartz-feldspar sand (Bornioli et al. 1995, Mandt 1977), pegmatite, mica (Radford et al. 1985), porphyry (Ociepa et al. 1988), etc.

There have been used lately the purposely made composites, i.e. homogeneous mixtures of the single clays or raw materials in an appropriate relation and with appropriate physical and chemical attributes.
Using the composites and feldspath and quartz sand replacements, the production costs are reduced.

The mine "Kosarno" clays belong genetically to a tertiary mioplicent deposit of the basin in Mladenovac. The deposit consists of three parts. For the production of the ceramics the most interesting is the second deposit part, which consists of four layers of ceramic and fireproof clays. The fourth layer (K-2) round 2 m great, is a fireproof sandy (rest on the sieve 0.1 mm 17-30%) plastic clay, dark gray colored, with feldspar fractions. It has a contact with the third deposit part.

The third deposit part is a round 20 m great layer of a sandy gray clay (rest on the sieve with 0.1 mm is 25-55 %), a mixture of quartz, clay, feldspar, kaolinised granite and mica. The composition of a layer is no homogeneous. With a deep decreases the clay content and the sand and feldspar content increases. It has been used in the production of tiles as a cheap feldspar, quartz and clay source.

Considering the K-2 and K-5 clay layer thickness, the exploitation technology with an excavator does not secure the permanent quality, and mostly is the mixture with a dominant content of the K-5 clay exploited.

## 2. EXPERIMENTAL WORK

### 2.1 Procedure

The clay K2 has been comminuted -5mm, dried on 105 °C, blunged in the water (S:L=1:2), without adding of deflocculant and disseminated on the sieves (d) 2.5, 1.6, 0.8,0.2, 0.091 and 0.063 mm.
The chemical and rational analyses are determined for each sieving rest as well as the presence of minerals (microscope analysis).

From underflow of the sieve 0.063 is the clay (K2-63) vacuum filtration isolated. It has been determined the particle size distribution for hydrocyclons in the class -63+0 jxm, and the clay in the class -11+0 /im (K2-11 /tm) isolated

The physical and chemical attributes of the clay are determined, as well as its rational content and the reaction during the diymg (Bigot curve) and heating (DTA, TG)

The rational analysis remainder on sieve has been calculated according to the chemical analysis of each class, and hypothesis that the loss of ignition arises from the mica type muscovite $KAl_2(Si3Al)0,o(OH)2$

2.2 Results

The physical attributes of the clay K2 are bending strength 154 1 $N/cm^2$, shrinkage (105/1240°C) 6 1/6 5%, remainder on sieve 0 091 mm 24 8%, and water plasticity 27 % (Pfeferkom 3 3) The chemical analysis has been shown in Tables 1 The Bigot curve has been shown on the Figure 1

Particle size distribution and the chemical analysis of the remainder on sieve has been shown in Tables 2 and 3 The chemical and rational analysis has been shown in Table3 and 4 The mıneralogıcal analysis has been shown in the Table 5

The physical qualities of the clay K2-63 urn are bending strength 79 7 $N/cm^2$, shrinkage (105/1240°C) 6 1/9 5 %„ and water plasticity 39 % (Pfeferkorn 3 3) The chemical analysis and partical size distribution of the clay in the class -0 063+0 00 mm has been shown in the Table 6 and 7

The DT and TG of the K2-63 um and K2-11 um clay has been shown on the Figure 3 and 4 The DT and TG of the K2-63 um and K2-11 um clays has been shown on the Figure 4

Table 1 The chemical analysis of the clay K2 (%)

| SıOı | $Al_2O_3$ | $Fe_2O_3$ | Cap | MgO | $K_2O$ | $Na_2O$ | IL |
|---|---|---|---|---|---|---|---|
| 63 47 | 21 67 | 2 34 | 105 | 0 52 | IS | 0 2 | 9 33 |

Table 2 The particle size distribution of the sieve residue (%)

| d (mm) | 0 063 | 0091 | 0 20 | 0 80 | 1 60 | 2 50 |
|---|---|---|---|---|---|---|
| % | 14 7 | 216 | 29 7 | 25 4 | 71 | 33 |

Table 3 The chemical analysis of the sieve residue

| d fim | S.O, | AUO, | FcO, | CaO | MgO | K,0 | Na,0 |
|---|---|---|---|---|---|---|---|
| 63 | 82 76 | 9 05 | 0 60 | 0 35 | 0 20 | 5 00 | 155 |
| 91 | 88 18 | 4 84 | 0 21 | 0 34 | 0 18 | 4 55 | 0 78 |
| 200 | 90 02 | 5 23 | 0 46 | 0 28 | 0 12 | 3 63 | 0 22 |
| 800 | 92 60 | 3 69 | 0 83 | 0 07 | 0 05 | 2 22 | 024 |

Table 4 The rational analysis of the sieve residue

| d(um) | Quartz | K-feldspar | Na-feldspar | Mica |
|---|---|---|---|---|
| 63 | 54 30 | 22 79 | 13 10 | 7 73 |
| 91 | 65 66 | 1404 | 6 59 | 14 64 |
| 200 | 74 82 | 18 73 | 169 | 3 14 |
| 800 | 82 66 | 6 61 | 169 | 741 |
| 200 63 | 64 93 | 18 55 | 7 05 | 8 50 |

Table 5 The mıneralogıcal analysis of the sieve residue

| d (mm) | Description |
|---|---|
| 2 54 | The corns of quartz (85%) are racily large, partly rotund, with the parts of the mica granular to uniform forms, and with perceived breach of the twins<br>The corns of the feldspar (15%) are bited into by the transformation, but they retained the primarily form with perceived parts of a fine corn quartz The look of a corn indicates that they originated as an effect of the mountain rock morphs |
| 150 | The quartz and feldspar corns are identical with the 2 54 mm sieve corns They differ because of parts of quartz with sphen parts and the presence of a black-gray quartz There are also some ferrohydroxide corns |
| D 80 | The quartz appears m fragments It is mostly limpid, sharp edged and wiui shelly break<br>The feldspar corns are bited into by the transformation, they lose their primarily form, they are extremely mat There is some free mica |
| 0 20 | The quartz is limpid, in fragments, rarely uniform, with eroded surfaces<br>The feldspar appears once as fresh, and partly bitted into by the transformation The content of the feldspar rises in regard to quartz |

Table 6 The chemical analysis of theK2-63 um clay

| $Si0_2$ | $Al_2O_3$ | $Fe_2O_3$ | CaO | MgO | $Na_2O$ | $K_2O$ | IL |
|---|---|---|---|---|---|---|---|
| 5202 | 2778 | 2 82 | 065 | 0 54 | 175 | 0 27 | 141 |

Table 7 The particle size distribution of me K2 63 |im clay (%)

| d(nm) | 63-44 | 44-33 | 33-23 | 23 15 | 15 11 | 11-0 |
|---|---|---|---|---|---|---|
| % | 7 76 | 5 93 | 4 38 | 4 76 | 3 16 | 74 18 |

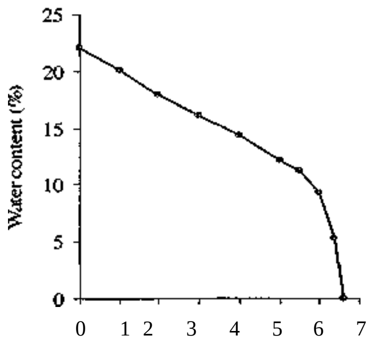


Figure 1 The Bigot curve of the K2 clay

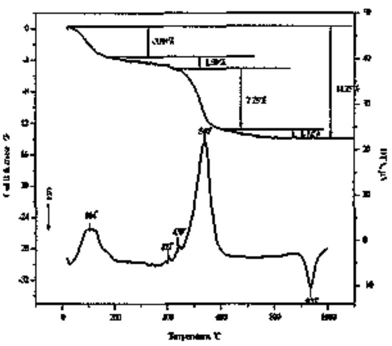

Figure 2 DTA and TG curves of the K2-63 um clay

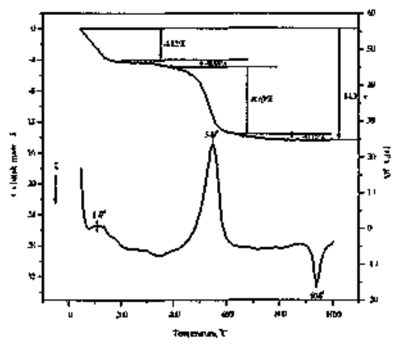

Figure 3 DTA and TG curves of the K2-11 um clay

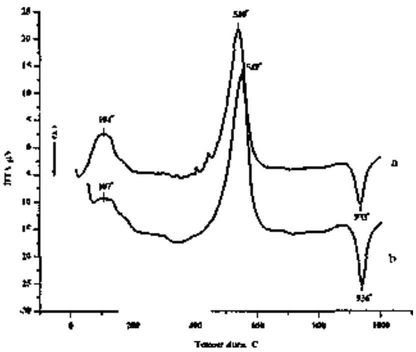

Figure 4 DTA and TG curves of the K2-63 (a) and K2-11 um (b) clays

## 3. DISCUSSION

Making categories using the moist sorting procedure on the control sieve 0 8 mm, 0.063 mm from a sandy clay, has for its result three products as follows

a) 9 5 % sand (-2 5+0 8 mm)

b) 17 5 %, quartz-feldspar sand (-0 8 +0 063 mm) and

c) 63 % clay (-0 063+0 00 mm)

In the sand the quartz corns are limpid, racily large, partly rotund, with parts of the granular to uniform forms of mica, and with perceived breach of the twins, the parts of sphen Some of them are from black corns. There are also some ferrohydroxide corns (Tab 5)

In the quartz-feldspar sand the quartz is limpid, appears m fragments, sharp edged and with shelly break The corns of a feldspar are extremely mat as a result of transformation It is concentrated m the class -0 2+0 063 mm m regard to reduced content of the quartz

According to its physical and chemical qualities as well as its reaction during drying and heating (Tab 6, 7, Fig 1-4) the clay belongs to the sediment type with a high content poorly orientated kaolmite The water content to the critical point is 9 45% The drying shrinkage is 6 38%, and water plasticity 35% (Pfeferkorn 3 3) According to the form of a Bigot curve (Fig 1) the clay is sensitive to drying (K=l 33) If it has been accepted that Fe and Mg were in the structure of the mica the clay contents (%), kaolmite 61 99, ortoklas 10 35, microkhn 1 7, quartz 27 26, mica 2 5 and anorthite 1 16

The K2-63 urn and K2-11 jam clays are similar, but according to the magnitude of the effect during dehidratation of kaolmite and originating of metakaohmte the clay K2-11 fim contents more kaolmte than the clay K2-63 um (Fig 4)

## 4. CONCLUSION

In the sorting procedure there have been abstracted 27% of sand (-2 5+0 063mm) and
73% of clay (-0 063 mm)

The sand can be parted into

- the concentrate of a quartz sand (9 5% m class -2 5+0 80 mm) which contents (%) $Si0_2$ 92 6, $A1_20_3$ 3 62, 0 8 $Fe_20_3$, and,
- the concentrate of a quartz-feldspar sand (17 5% in class -0 80+0 063 mm) which contents (%) quartz 64 93, ortoklas 18 55, microkhn 7 05 and mica 8 5,

The clay which contents (%) kaohmte 62, quartz 27 3, and feldspar 10 35 belongs to a ball clay type It is fireproof, plastic, good workable and sensitive to drying

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