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MINERALOGICAL ANALYSIS OF THE MOROCCAN RAW MATERIAL FOR THE TECHNIQUE OF SCREENING IS SUPPORTED BY STATISTICAL STUDIES

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Abstract. *This study concerns the results of Mineralogical analysis of a Moroccan raw material for the technique of screening who is supported by statistical studies and determination of its nature and its chemical structure. Several techniques were used; in particular X-ray diffraction (XRD), scanning electron microscopy coupled with EDX microanalysis (SEM-EDX), differential thermal and gravimetric analyses (DTA-TGA) and finallyinfrared Fourier transform (FTIR) and X-ray fluorescence (XRF).*

Keywords: *mineralogy, screening, refusal size, equivalent diameter, statistical parameter.*

1. INTRODUCTION

The objectif of this work is to Correlate the results obtained in the form of frequency curves by weight in determining the number of components of a powdery material; to Apply a new statistical method of "total surface" for the quantification of the composition constituents of the same material studied and to Check the validity of the method for surface combined with the use of a powdery material composed of powders of single phase purity greater than or equal to 97%.

2. MATERIALS AND METHODS

2.1. TECHNICAL ANALYSIS OF SCREENING FOR THE MINERALOGICAL

The refusal size is defined by the relation $\phi_e \geq \phi_t$ where ϕ_e is the equivalent diameter by sieving, equal to the diameter of a grain; ϕ_t corresponds to the opening of a sieve (in microns).

Tracing frequency curves weight showed us as many peaks as components (see Figs. 1, 2 and 3). Indeed, if the material is formed of a single component, the frequency curve in weight shows a single peak (see Fig. 1). However, if the material is composed of two components, the frequency curve shows two peaks in weight (see Fig. 2), and if the material is composed of three components, the frequency curve shows three peaks in weight (see Fig. 3) It should be noted that the mineralogical identification of the peaks for the various constituents was confirmed by X-ray diffraction .

The shape of the frequency curves in surfaces depends on the number of constituents of the material studied.

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Indeed, the frequency curve for a surface material to a single component still shows a linear curve, while a material with two or more constituents always shows a S-shaped curve. The importance of this method lies in the quantification of the composition constituents of the material studied as shown in Figs. 2-3.

2.2. QUARTILE METHOD

This method was explained for the 1st time the sands by P.D.TRASK (statistician) in 1930, it was not until 1980 that this has taken FOLK quartile method: to achieve by developing statistical relationships further by introducing more accurate judgments. Quartiles according Folk are seven points of the cumulative curve: the first quartile $\phi95$ is the point of the curve for which the equipment is 95% larger than that of the size considered and 5% lower.

- the second quartile $\phi84$ is the point on the curve for which 84% of the material is larger than that of the size in question and 16% lower.
- the third quartile $\phi75$ corresponds to the size for which 75% of the material is larger than that of the size in question and 25% lower.

The fourth quartile $\phi50$ corresponds to the size for which 50% of the material is larger than that of the size and 50% considered below. Other quartiles are introduced ϕ 25, $\phi16$ and $\phi5$ correspond respectively to 25, 16 and 5% diameters.

Using the quartiles Folk has identified a number of statistical parameters namely:

1) average particle size that is defined by the average of three quartiles: $\phi84$, $\phi50$, $\phi16$

$$\phi e =(\phi84+\phi50+\phi16)/3 \qquad (1)$$

2) arithmetic quartile deviation

$$\sigma q =((\phi84-\phi16)/4+(\phi95-\phi5)/6.6) \qquad (2)$$

3) asymmetry of the histogram: Sk (Skewness):

$$Sk =((\phi84+\phi16 -2\phi50)/2(\phi84-\phi16)+(\phi95+-\phi5-2\phi50)/ 2(\phi95-\phi5)) \qquad (3)$$

4) angularity of the histogram K (kurtosis):

$$K =((\phi95-\phi5)/2.44 (\phi75-\phi25) \qquad (4)$$

5) curve likelihood (Trask 1930).

We obtain a probability curve with the ordinate in the report cumulative area of each class of its total area of all classes, and the abscissa the sieve size, if the curve points lie on a right we have to make a single component and the inclination of the line will depend on the grain dispersion of the particles.If there is presence of two or more components resulting in a dip in the curve (S curve), it is possible by examining the probability curves and frequency to deduce the number of components in a given material and its component composition.

3. STUDY OF SOME PARAMETERS AS FOLK STATISTICS

3.1. CASE SAND "STRASS" FIGURE 1d

1) ϕ_e = 245 µm is the average grain diameter,
2) σq(deviation) = $0.24\phi_e$ means that the sand is well sorted.
3) Sk (skewness) = - 0.12 property belonging to the interval [-0.2; +0.2], which means that the size distribution is highly symmetric reflecting the high purity sand crystals (>98%).
4) angularity (K): K = 1.02: this high value is certainly closely related to the high asymmetry of the peak.

3.2. CASE FELDSPAR DEVELOPED IN FIGURE 1b

1)ϕ_e = 86µm is the average grain diameter, the mode who is the top of the frequency curve coincides with the average diameter .
2) σq(deviation) = 0.18ϕ means that the feldspar is well sorted.
3) Sk (skewness) = - 0.2, although belonging to the interval [-0.2; +0.2], which means that the size distribution is highly symmetric.
4) angularity (K): K = 1.09: this high value is certainly closely related to the high asymmetry of the peak.

Frequency curves in weight and surface of a material in binary mixture theory

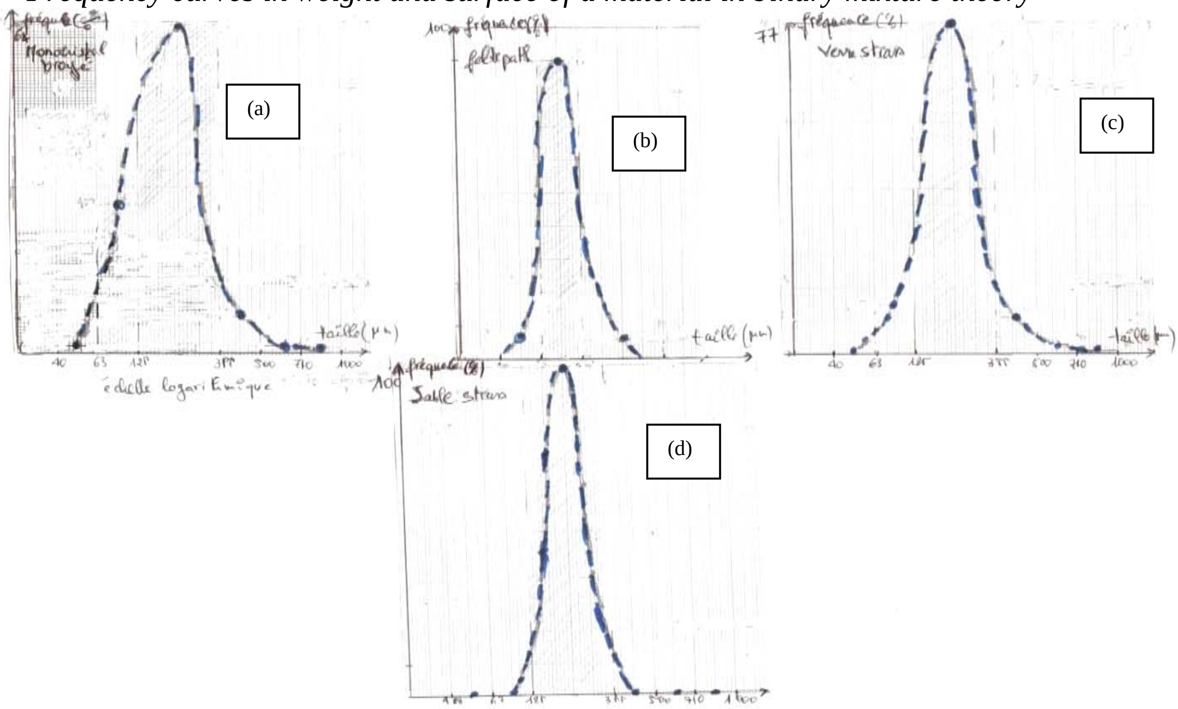


Fig. 1. Frequency curves by weight of the standard single-phase (a) - Barite (b) - Feldspar (c)- glass strass (d)-Sand strass.

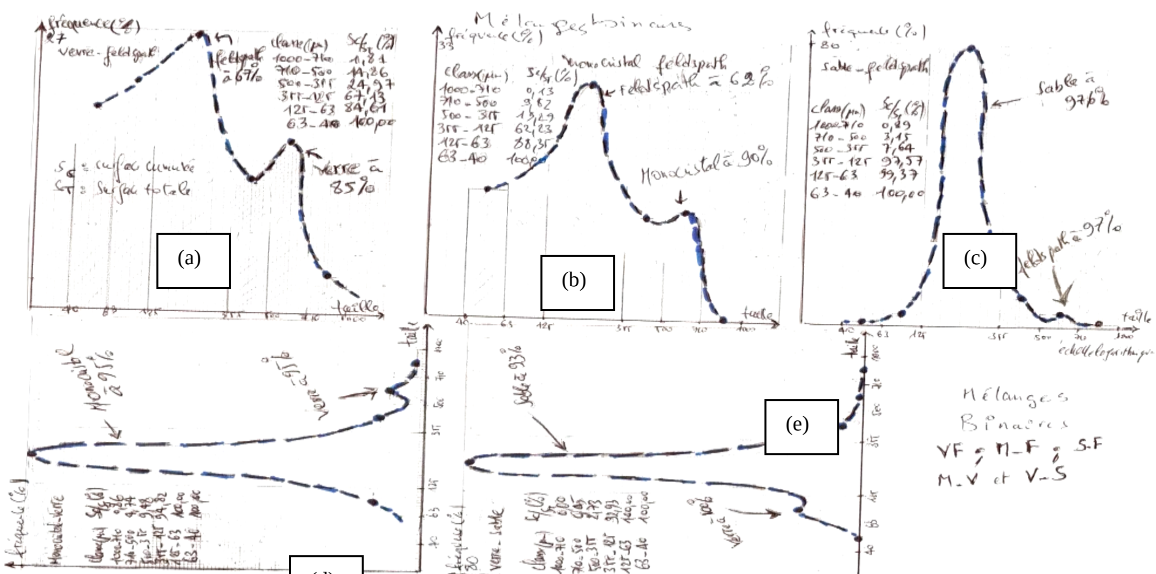
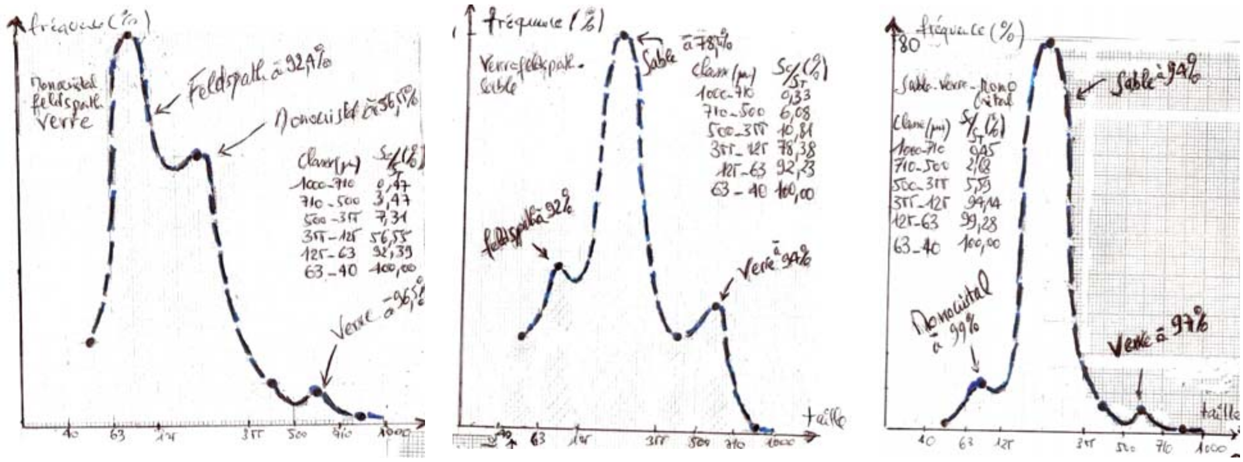


Fig. 2. Frequency curves [illegible] standards in binary mixture. (a) glass strass + Feldspar (b) feldspar + Barite (c) feldspar + Sand strass (d) glass strass + Barite (e) Sand strass + glass strass.



a b c

Fig. 3. Frequency curves weight standards in ternary mixture. (a) glass strass + Feldspar+ Barite (b) glass strass +feldspar + Sand strass (c) Sand strass + Barite + glass strass.

4. CONCLUSIONS

While in most of cases the diffraction is able to identify which group minerals (mica, smectite, vermiculite), it is however unable to distinguish clay minerals in the same group. It is in this kind of study that thermal analysis provide invaluable assistance to the X-ray diffraction.

Indeed, the thermal study of Moroccan raw material allowed us to have cristobalite to 950 ° C. This led us firstly to classify the clay in which domain [2], on the other hand, other authors [3] showed that the exothermic reaction located around 830-850°C is a good criterion to distinguish in the field of bentonite. As for the peak located around 790-850°C, we can attribute it to the amount of iron in the octahedral sites [4].

We're in the presence of clay materiel progresses to iron with lattice parameters remain constant but whose chemical compositions are variable with tetrahedral substitutions Si→Al and octahedral substitution Al→Fe .

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