

pH of the pulp because the composition of the ore is a criteria for choosing what media to effectively carry out successful flotation. Therefore, there is need for proper understanding of the mineral composition of any deposit before processing it. In the flotation of sulphide ore containing copper, lead and zinc, the flotation process must be carried out under a well-controlled pH. The first stage will be to float copper at pH of 6 during this stage, the lead and zinc must be depress because they will not float very well at lower pH. The second stage will be for floating lead while zinc is still depressed. Then the pH will be raised to say between 7.5 and 9 by adding lime. The final stage will be to float zinc. The pH will be raised to up to 10.5 to 11 while copper sulphate will be added to re activate the zinc [10].

The two deposits have not been fully explored for mineral processing. A few authors have studied the geology of the areas. [11] studied the geochemical of gold deposit in the area while [12] explored the In vitro Bio accessibility of lead in artisanal mining contaminated soils and sediments from the same area.

The thrust for this work centers on the comparative analysis of the effects of mineralogy on flotation of two deposits (Anka and Ishiagu) from Nigeria. There is need to study how these deposits respond to processing as a result of variation in their mineralogy.

II. PROCEDURE FOR PAPER SUBMISSION

A. Sample preparation.

The sulphide mineral ores used for this study was sourced from Anka North West (50° 5' E and 60° 08' E and 110° 51' N and 120° 08' E) Nigeria. The ores were pulverized with the laboratory jaw crusher to reduce the pebbles to all passing 1 inch which was the minimum size of the set. The resulting products were sieved to remove under size particles while the oversize samples were transferred to Denver ball mill for further milling. After milling, the samples were thoroughly mixed together separately to obtain homogenous mixture. The ground samples were divided into four parts using the Jones Riffler. One portion of each product was used for particle sizing. The sieves Endecott standard set, were arranged in a stack of descending order of aperture using the $\sqrt{2}$ method to select successive sieves and the retained particles on each sieves were weighed and recorded for particle size analyses.

B. Determination of chemical compositions

Chemical compositions of the samples were carried out with Inductively Coupled Plasma Optical Emission Spectroscopy ICP-OES, ICP 9000. Based on the economic liberation from the particle size analyses, particle size fractions of +150, -150 +106, -106 +75 and -53 μm were selected for ICP-OES analyses. 3 g of each particle size fraction were weighed and digested in aqua regia of 3:1 HCl:HNO₃. The suspension was digested for 16 hours at room temperature and at 1300°C for two hours to give it enough time to digest. It was later filtered and the filtrate was made up to 100 mls by adding deionized water and the resulting products were taken for the analyses.

C. Characterization by XRD

X-ray diffractometry was used to determine the mineral

phases of the ores and this was carried out for quantitative and qualitative analyses. The powdered samples were separately prepared by back loading system. Ring shaped sample holders were degreased with acetone after which the samples were introduced to them just to fill the cups to the brim. All the samples were then loaded at the same time into the machine, XRD PANalytical Empyrean. The PANalytical Empyrean diffractometer was equipped with Pixel detector and fixed slits with Fe filtered Co-K α radiation. The phases were identified using X'Pert High score plus software. The relative phase amounts (weights %) were estimated using the Rietveld method.

D. Morphological and quantitative analyses

Morphological and quantitative analyses of the samples were carried out to determine the morphology, grain size, structure, shapes, and associations of major and minor elements embedded in the minerals. The SEM-EDS was carried out with the field emission microscope JEOL JSM 7600 SEM and a sputter coating machine. The SEM provides the information for the physical properties of the minerals while the EDS provides the information on their chemistry. The samples were coated with iridium to minimize the effects of charging during the analyses of the samples.

E. Study of flotation behaviour of Anka and Ishiagu sulphide ores.

Flotation tests were carried out on Anka and Ishiagu sulphide minerals in accordance with ISO 23499-2008 to compare the effect of mineralogy on the flotation behaviour on the two deposits. The pulp was made up of 40% solids of the sulphide ore, transferred into the flotation tank and agitated at speed of 1500 rpm to form a homogenous pulp. The initial pH of the pulp was checked with electronic pH meter. The pH was adjusted to 9.50 by adding lime (CaO). The agitation was allowed for 5 minutes followed by the adding 0.02 g ZnSO₄ to depress zinc present in the pulp followed by addition of 0.05 g Potassium Amyl Xanthate (PAX), collector and 0.2 mls of Methyl Isobutyl Carbinol (MIBC) as frother. The pulp was aerated for 3 minutes and the froth collected as the first concentrate. Thereafter, 1 ml of 0.5 M NaOH was added to condition the pulp before adding 1% solution of soluble starch to depress lead. CuSO₄ was added to activate the zinc. Another installment of the collector and frother were added and the pulp was aerated and collected as the second concentrate. The flotation process was repeated with other different collectors (Sodium oleate and Sodium Ethyl Xanthate, SEX) and depressants (Potassium dichromate and sodium silicate). The recovered concentrates were collected and dried and analyzed.

III. RESULTS

A. Economic liberation of Anka and Ishiagu sulphide minerals

Figures 1 (a) and (b) show the economic liberation of Anka and Ishiagu sulphide minerals. Although there was variation in their particle size distributions, their economic liberations were very close.

