A STUDY OF THE DECK ANGLE INFLUENCE ON THE PERFORMANCE OF AN RP4 SHAKING TABLE

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ABSTRACT

In this project the influence of a shaking table's deck angle on its efficiency was researched. Three different sample types were used to help complete this study. These were a composed sample, the concentrates of an Icon concentrator and a ball mill sample which was concentrated using an Icon concentrator. The Composed sample and the ball mill sample were made out of material from a previous study done at NV Grassalco. The concentrates from the Icon concentrator came from a small scale gold mining operation. Out of the project was concluded that the deck angle has a great influence on the efficiency. Even though the literary study suggested that a separation would be successful for a deck angle range from 0 to 9 degrees, the study delivered different results. For a smaller deck angle (0° to 1°) all of the materials went into the concentrate fraction. For a deck angle larger than 6°, all of the material was washed away with the tailing. Also was concluded that the type of material used has an influence on the deck angle and thus also influencing the efficiency. The deck angle is not a parameter that can be pre-fixed, it needs to be adjusted by the operator while processing the material.

KEYWORDS: gravity concentration, RP4 Shaking table, separation, samples from NV Grassalco

1. INTRODUCTION

Gravity concentration is one of the oldest techniques for separating minerals and it relies on the difference in specific gravities between the minerals. The shaking table is a device that utilizes the gravity concentration method by dividing minerals based on their difference in densities and forces such as the drag force and the buoyancy force. *(Holman Wilfley trail report)* The separation depends on the motion of particles according to density and size moving in slurry across an inclined table, which moves backwards and forwards essentially at right angles to the slope, in combination with riffles which hold back the particles which are closest to the deck. This motion and configuration causes the fine high density particles to migrate closest to the deck and be carried along by the riffles to discharge uppermost from the table, while the low density coarser particles move or remain closer to the surface of the slurry and ride over the riffles, discharging over the lowest edge of the table. *(Wills et al., 2006)* The separation of minerals is also dependent on the process variables of the shaking table. The shaking table has six variables which influence its efficiency; one of these variables is the deck angle which operates within a deck range of 0˚ to 9˚*. (Holman Wilfley trail report)* The purpose of this study is to gain more knowledge as to how the deck angle influences the efficiency of a shaking table and to find out between which angle ranges the separation of minerals is best.

2. METHOLOGY

To carry out the testing of the deck angle, an RP4 shaking table(figure 1) was used. The testing took place by adjusting the deck angle, putting the samples into the feed compartment and watching the separation of the heavy and light materials. At an ideal separation there should be a clear division visible between light and heavy materials and the materials should go into the right product fractions(figure 2). The heavy materials should go into the concentrate fraction and the lighter materials should go into the tailing fractions. The RP4 shaking table has a third product fraction, this is the middlings fraction. In the middlings fraction there is usually a mixture of heavy and light materials, the material of this fraction is put through the shaking table again so that the heavy materials could be separated.*(Figure 3) (Holman Wilfley trail report)*

Figure 1. Photograph showing the deck of the Rp4 shaking table (Photo by Ramon Finkie)

Figure 2. **Photograph showing the division between the light and heavy materials (Photo by Samantha Bilkerdijk)**

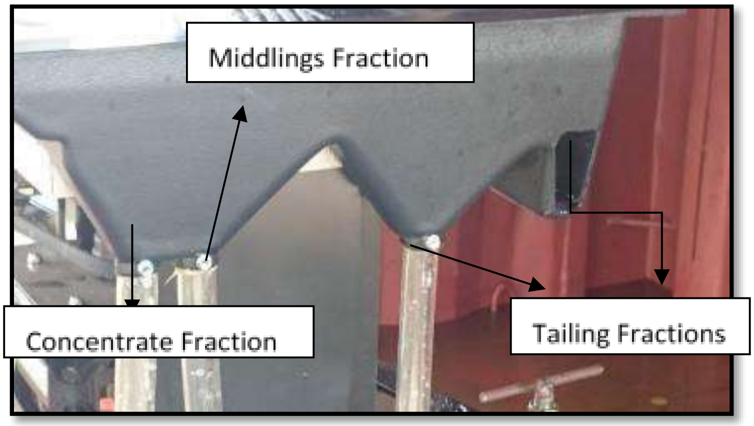

Figure 3. Product fractions of the Rp4 shaking table

Test procedure

The first test was done at an angle of 4° for both the composed and the test sample. The second test was done at an angle of 6°, and the third test was done at an angle of 1° for both the composed and the test sample.
For the last test it was decided to find the proper angle at which the separation was successful. The samples were put into the feed compartment after which the angle was adjusted by watching the flow pattern (the heavy materials had to be heading in the concentrate fraction). After the angle was adjusted it was measured using the inclinometer. The right angle, with which a clear separation was possible, was between 3˚ and 4˚. Based on the results of the first couple of tests, was then decided to use the Ball mill discharge sample of N.V. Grassalco processing plant to verify the results.
Using the inclinometer the deck angle of the shaking table was adjusted at 3-4˚. After this the sample was put through the shaking table and the separation observed. There was a clear separation visible between the light and heavy material, but they were not heading to the correct product fractions. After this was observed, it was decided to find the proper angle at which the separation was successful. The deck angle was adjusted so that the separation was successful and that the material was heading to the correct product fraction. After measurements an angle of 2˚-3˚ was found. The product fractions were collected ad a sieve analysis was done on them.

3. RESULTS AND DISCUSSIONS

Results of the deck angle testing

With a deck angle of 4˚ it was observed that for both the composed and the test sample, the heavy materials went into the middlings fraction instead of the concentrate fraction. With an angle of 6˚ it was observed that almost all of the material went into the tailing fraction and next to nothing went into the middlings fraction for both the composed sample as the test sample. Because of the fact that the separation at 6 ˚ was poor, it was decided not to test the deck angle of 8˚ simply because the test indicated that a separation at 8 ˚ would not be possible. With both the composed and test sample it was observed that with an angle of 1˚, almost all of the material went into the concentrate fraction, some of it went into the middlings and tailing fraction. It was also observed that at this angle, there was a lot of water on the deck. Without an angle it was hard for the water to flow off the deck, this hindered the separation process.

Results of the sieve analysis

In figure 4 the passings of the feeds are compared to each other, here it can be seen that the composed sample contains more coarse materials than the other two samples. Also can be seen that the test sample contains the finer material compared to the other two samples.

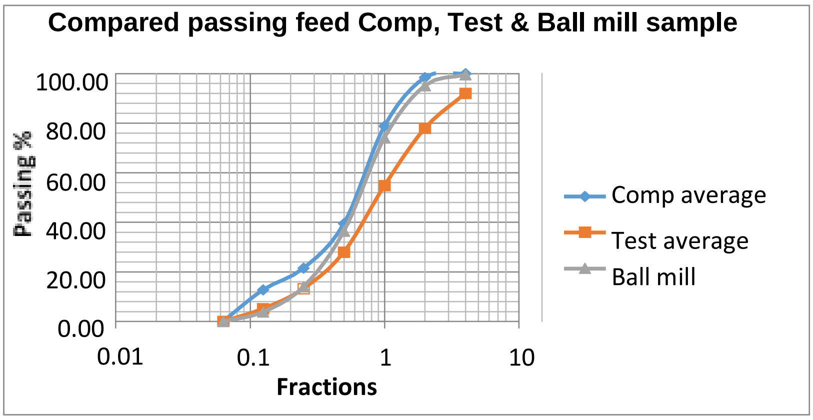

Figure 4. Graph showing the compared passing of the feeds

In figure 5 can be seen the plotted passings of the tailing of the composed samples. From the results can be seen that the plotted passing of 6˚ has the coarsest material compared to the other two. This is understandable because during the testing almost all of the material went into the tailing fraction.

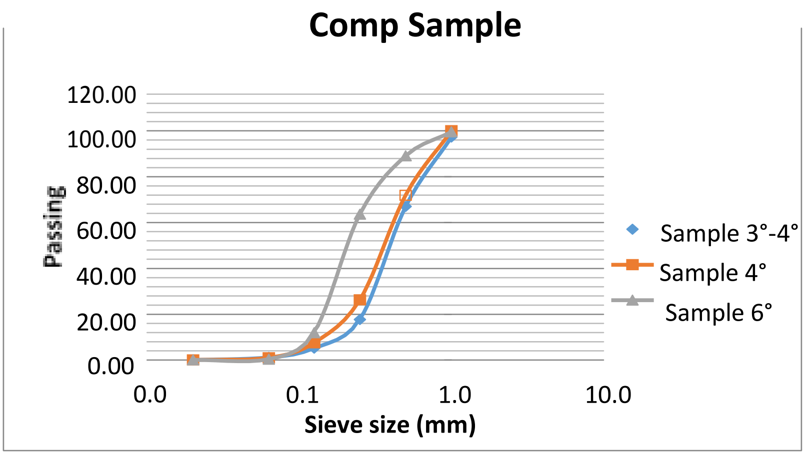

Figure 5. Graph showing the tailing passings of the composed sample

From figure 5 can be seen that about 60% of the material in the plotted passing of 6˚ is smaller than 0.25mm, for the plotted passing of 4˚ about 30% of the material is smaller than 0.25mm and for the plotted passing of 3˚-4 ˚about 20% of the material is smaller than 0.25mm. The information from figure 5 show that with a greater deck angle a larger amount of finer material is present in the tailing and with a smaller deck angle the tailing material seems to be coarser. For material smaller than 0.125mm, the materials seem to have a similar plotted passing. Out of this can be concluded that for material smaller than 0.125mm, the deck angle doesn't have such a huge impact on the separation. Figure 6 shows the passing of composed concentrate.

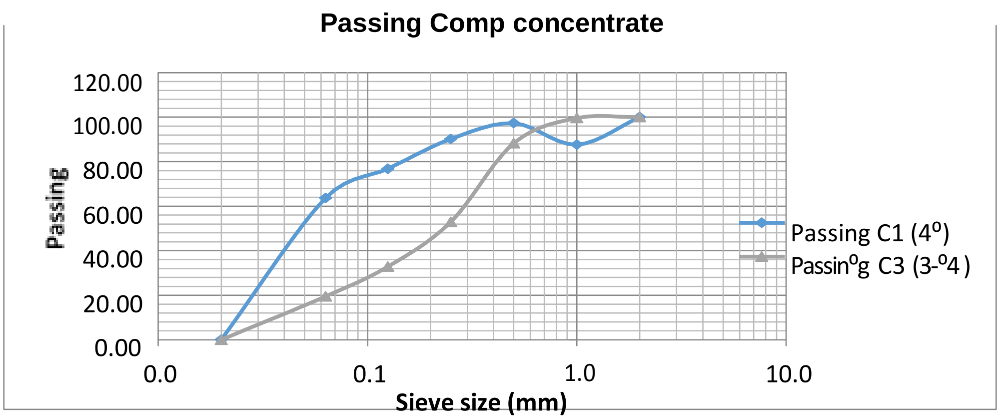

Figure 6. Graph showing the passing of Comp concentrate passing

From the results in figure 6 can be seen that about 75% of the material in the plotted passing of 4˚ is smaller than 0.125mm and for the plotted passing of 3˚-4˚about 30% of the material is smaller than 0.125mm. Out of this information we can see that with a greater deck angle coarser material is present in the concentrate. This observation corresponds with the one earlier made, stating that with a greater deck angle there is more finer material present in the tailing. In figure 7 can be seen the passing of test sample.

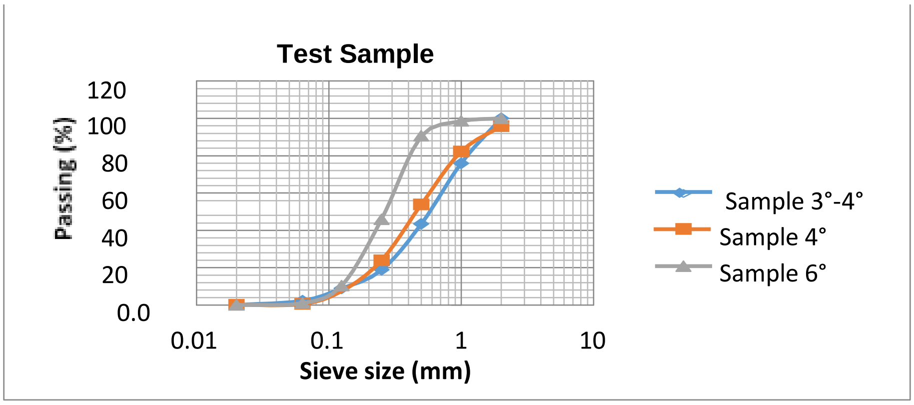

Figure 7. Graph showing the passing of tailing test sample

From the results in figure 7, it can be seen that just like the composed samples the plotted passing of 6˚ has the coarsest material compared to the other two. Also can be seen that about 50% of the material in the plotted passing of 6˚ is smaller than 0.25mm, for the plotted passing of 4˚ about 25% of the material is smaller than0.25mm and for the plotted passing of 3˚-4 ˚about 20% of the material is smaller than 0.25mm.

Out of this information can be said that with a greater deck angle a larger amount of finer material is present in the tailing and with a smaller deck angle the tailing material seems to be coarser.

Just like the composed sample the test sample also seems to have a similar plotted passing for material smaller than 0.125mm. Meaning that material smaller than 0.125mm, the variation of the deck angle doesn't have such a huge impact on the separation.

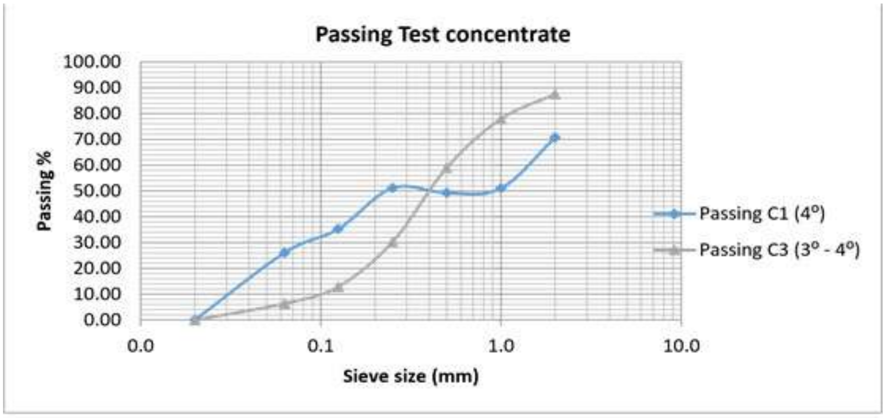

Figure 8. Graph showing the passing of the test concentrate

From the results in figure 8 can be seen that about 50% of the material in the plotted passing of 4˚ is smaller than 0.5mm and for the plotted passing of 3˚-4 ˚about 30% of the material is smaller than 0.5mm.

Figure 8 shows that with a greater deck angle coarser material is present in the concentrate compared to the other two deck angles. This observation corresponds with the one earlier made, stating that with a greater deck angle there is more finer material present in the tailing.

Figure 9 is a histogram in which can be seen that the amount of ball mill materials concentrated is less than the amount of materials present in the tailing for each size fraction.

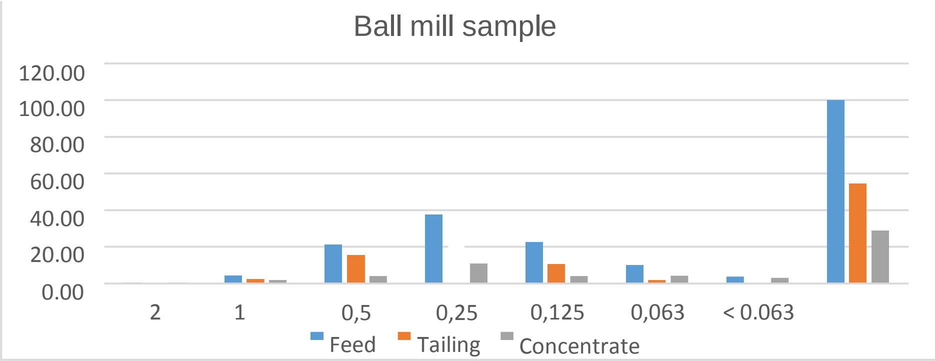

Figure 9. Histogram showing the retained material of the ball mill sample

4. CONCLUSION

From the results of this research can be concluded that:
the deck angle has a great influence on the efficiency of the RP4 shaking table and it is an operational variable that requires constant operator's attention,
the increasing of the deck angle, the amount of finer material present in the tailing increase too, and
the type of material used in this research can be separated successfully between an angle deck of 3˚ and 4˚.

5. ACKNOWLEDGEMENT

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