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Providing Unique Processing Solutions To The World

## **The History of the Deswik Mill**

During the mid '90s a global law was adapted banning the presence of any iron bearing salt in ground water. The reason was that iron salts destroy the natural Algae present in ground water that significantly contribute to the destruction of pollutants such as detergents, etc.

Des Erasmus, then a Chemical Engineering consultant, was requested by a major South African corporation to investigate new methods for the manufacture of Magnetite based pigments other than the conventional precipitation method. Magnetite is a black iron oxide pigment used for the colouring of ultra violet resistant roofing tiles, paving bricks, rubber and plastics. The conventional method was to dissolve scrap carbon steel in either Sulphuric or Hydrochloric acid to produce either Ferric Chloride or Sulphate. By variation of the pH the various iron oxide pigments could then be precipitated. Inevitably with each of these processes iron salts are discharged which end up contaminating the ground water.

Des investigated various alternate chemical processes but found that in all cases either iron salts were a contaminant or the process cost was too high. Finally the decision was made to investigate the milling of naturally occurring Magnetite to produce the pigment. High quality Magnetite pigment has a mean particle size (D50 of  $0.2\mu$ ). This is approximately 200 times smaller than the lower limit of human vision.

In South Africa large amounts of high quality Magnetite is available as a by-product of the Copper mining industry; these are several millions of tons. Magnetite, incidentally, is one of the largest naturally occurring minerals on the globe.

At first the idea of milling the Magnetite, which was available as a 90% smaller than a  $45\mu$  particle, alternately 90% smaller than  $300\mu$ , seemed to be easily achieved. The smaller than  $45\mu$  material was mostly used to produce heavy media separation media whereby coal dust is floated off using Magnetite as the carrier.

To achieve the goal of a  $0.2\mu$  particle Des made use of the various conventional mills available in South Africa. He soon discovered that the best particle size he could achieve was around a mean particle size of  $45\mu$ . In an effort to achieve better results a conventional European bead mill was acquired. However it was found that not even this mill could achieve a particle size smaller than  $10\mu$  mean size. Des then embarked on a campaign to design a bead mill that can do the job required, to mill down to a mean particle size of  $0.2\mu$ . The development of the mill took nearly a year whereby different wear materials, impeller designs, dimensional changes and types of grinding media were experimented with. The end result was a mill that could mill Magnetite from a feed size of  $75\mu$  down to a mean size of  $0.15\mu$ .

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The original design was horizontal. This design was used for some two years on a large variety of different products apart from Magnetite. During this period various shortcomings in this design was noted and the most important of these were:

- Cavitation at elevated impeller speeds
- Back pressure in the barrel due to screen blockages
- Destruction of the mechanical seal
- Seizure of the impeller due to bead compaction
- Low production time utilization due to excessive maintenance requirements
- Excessive impeller wear

Wikus Erasmus started experimenting with a vertical design in an effort to eliminate some of the above shortcomings. The first unit was built from a 5L paint can with nuts, bolts and all sorts. After working on the unit for a period of six months the first usable unit was built.

With some gradual improvements, which continue until today the mill has proved itself to be one of the best available for product micronisation and surface area enlargement. All of the problems experienced with horizontal milling were successfully eliminated.

### **The Inventors**



**Des Erasmus**



**Wikus Erasmus**

### **The First Deswik Prototypes**

