We’re the largest global paints and coatings company and a major producer of specialty chemicals. We supply industries worldwide with quality ingredients for life’s essentials. We think about the future, but act in the present. We’re passionate about developing sustainable answers for our customers. Based in Amsterdam, the Netherlands, we have 60,000 employees working in more than 80 countries – all committed to excellence and delivering Tomorrow’s Answers Today.

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Your partner for a sustainable future

By developing highly efficient flotation reagents or supply of standard flotation agents, we try not only to improve flotation properties themselves, but also to restrict the effects on the environment.

This is becoming increasingly important when choosing flotation agents. Backed up with our commitment to Responsible Care, Product Stewardship and REACH, we believe that supplying the right chemistry goes beyond just selling products.

As a consequence, our technical service has, for several years, included a comprehensive analytical coverage of the immediate environment surrounding our client’s sites in order to contribute to safeguarding the foundation of our common future – planet Earth.
Tailor-made or standard collectors— we approach each assignment individually assuming more the role of the customer’s partner than that of a traditional supplier.

For a sustainable future
Our focus is not only to provide highly efficient flotation reagents, equally important is also to focus on a sustainable future. We want and are able to support you with knowledge on the behaviour and impact of our collector chemistry in your environment. We achieve this by doing a thorough risk assessment. We are also able to support you in other regulatory issues. We are backed-up by an experienced staff of toxicologists, a world class analytical department and last but not least the experience of our team.

Our strengths – optimized solutions
The strength of our chemistry and process know-how lies in the fact that we customize solutions to fit each individual ore. And since the ore varies in composition, we must vary the process and adapt it to each individual case. These products are not to be found in a catalogue, they must be tailor-made in close cooperation with the customer.

There are other ores that would not, at present, benefit from a special flotation agent. Instead, the task is to find a standard flotation agent with the performance characteristics best suited for the ore in question.

How do you achieve successful flotation? The process needs to be used in such a way that it will enable you to retain maximum benefit from the unique ore composition in your plant.

We are at the forefront of the advanced colloid and surface chemistry upon which successful flotation depends. This has been achieved by over 40 years of research and development into the molecular and surface chemistry together with feedback from the field.

A wide range of applications
Successful flotation requires optimum interaction of all the components in the flotation process. The main role in this process is usually played by collectors.

Collectors must, therefore, meet very high performance requirements. Ideally, collectors should be:

- strong enough to enhance recovery but weak enough to enhance selectivity
- able to provide a high rate of flotation and good froth
- non-sensitive to variations in the composition of the ore and the quality of the water
- designed to meet environmental requirements
- easy to ship, store and handle
- cost effective

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Our flotation collectors are recognized under the following trade names:
Armee®
Armoflote®
Atrac®
Berol®
Ethomeen®
Lilaflote®
Flotation of iron ore

The main target in flotation of iron ores is to improve quality. This is achieved by removing silicate minerals or phosphorus containing minerals.

We have for more than 25 years developed flotation systems both for hematite and magnetite type of iron ores and are now the leading company in this area.

The use of silica flotation has increased over the last decades. This will continue as more complex ores have to be mined and higher grade iron ore concentrates with lower impurities are requested by the steel industry.

Flotation systems to remove silica from magnetite ores has to be designed differently compared to the systems for treatment of hematite ore. The reasons are several but in all magnetite flotation, the collector must have the capability to float mixed grains magnetite-silica. In hematite flotation, the most normal case is to float fully liberated quartz from hematite.

Our collectors are used to produce high-grade concentrates for iron ore pellet production. They can also be used for production of super-concentrates for advanced metallurgical applications.

Case Study

The problem brought to us was, how to improve the iron ore concentrate quality with respect to phosphorus? The concentrate was intended for the production of pellets. The conditions given were that the pulp temperature fell to 4°C during the winter and no negative influence of flotation chemicals on the pelletizing process could be tolerated.

Solution

A long-term reagent development project led to a flotation process using 70g/tonne of a collector that floated the phosphorus containing minerals. Thus, 90-95% of the phosphorus content could be removed by flotation. The loss of iron was about 2%.

For flotation of iron ore:

Atrac®, Lilaflot®

Flotation of phosphate/apatite

Processing of phosphate ores is often a straightforward and proven technology. Especially for ores that contain only phosphates and silicates. For the more complex ores where carbonate minerals are present the situation is different.

For these types of ores it has been difficult to produce high quality phosphate concentrates.

Main reason is that the traditional fatty acid collectors do not only float the calcium mineral apatite but also the other calcium minerals, calcite and dolomite.

We have made a breakthrough in this area and are the only company that can offer collectors that only float apatite without any need for depressant. This technology is used by phosphate industry worldwide with results showing concentrate grades up to 39% P₂O₅ and less than 1% MgO.

The technology – collector and process – gives the best results when adjusted for each specific case.

Case Study

We were contacted by a company that used fatty acid to float the apatite. As the fatty acids are not very selective in the finer fractions the material had to be deslimed at 100 micron prior to flotation. The loss of phosphate to the slime product was considerable. The target set for the collector development project was to improve productivity (recovery) and concentrate grade.

Solution

The first approach from our side was to try to float the entire (undeslimed) feed. This scheme was successful in laboratory and pilot scale but failed in full-scale due to lack of filtering capacity. The process was therefore redesigned with deslime at 44 micron prior to flotation. In spite of the losses of P₂O₅ in the -44 micron slime product the overall recovery of P₂O₅ could be increased to 82% which resulted in a capacity increase of more than 10%.

For flotation of phosphate/apatite:

Atrac®, Bero®

We at AkzoNobel are proud to be able to help the steel industry with more efficient use of our planet’s resources.

Our Atrac products are used to float phosphate, used as fertilizers to help increase the crop yield for the farmers in the world.
Flotation of calcite

Our customised collectors remove silicates and graphite from calcite to improve brightness and abrasiveness.

Natural calcite deposits contain various types of silicates and graphite. For applications like paper fillers the calcite has to have a low grade of abrasive silicates as well as a high brightness. Also very low amounts of graphite are detrimental to the brightness. We are today the world leading supplier of flotation collectors for cleaning of calcite. In our laboratory we can fine tune our products to the very special requirements of your ore.

Case Study
One successful example that describes how we interact with our customers is the mutual development work together with a company that floats the silicates as well as graphite from calcium carbonate. They wanted to substitute the two collector system with a single two functional one.

Solution
A project team with members from the development departments of both companies was formed. After the joint effort, a new tailor made product was born that fulfilled the demands of selectivity and efficiency. As a result the time consumed in the development work was much shorter due to this fruitful collaboration.

Considering the importance of calcite in the paper industry, we recommend using our Lilaflot®, Armoflote®, Armeen® and Ethomeen® collectors for improved results.

Next time you are writing on a letter or reading a book, have in mind that brightness in paper is obtained by using our silica collectors. The collectors are used to remove dark minerals as well as abrasive minerals such as quartz and other silicates.

Flotation of potash

Potash is the most important source of potassium in fertilisers. Flotation is one of the major methods to upgrade the potash.

We are the world-leading supplier of collectors to the potash industry. For direct flotation of potash we can deliver either standard amine produced from different types of fatty acids but also special formulations. We can also offer collectors for reverse flotation of salt from the potash.

Case study 1
We were asked for help by customers where clay was a serious disturbing factor in the main flotation.

Solution
Our R&D group developed different tailor-made collectors that gave improved performance and eliminated this production bottleneck.

Case study 2
This time the challenge put forward by our customer was to improve the sylvite flotation by removing slime content and also improve the overall recovery.

Solution
A long-term reagent development project led to a new slime collector that effectively reduced slime content from sylvinites with improved recovery. In addition to this the flotation rate was hereby improved with the result of a higher throughput.

Potash recovered with our products is an important ingredient when growing juicy, sun ripe tomatoes.

For flotation of potash:
Armoflote®, Armeen®, Ethomeen®

For flotation of calcite:
Lilaflot®, Armoflote®, Armeen®, Ethomeen®
Improving your process with statistical methods

The practical and theoretical parts of the development project go hand in hand.

The use of experimental design (DOE) and multi-and mega-variate data analysis (MVDA) has improved the work to optimize the collector and process parameter design.

These examples are from reverse flotation of silica from magnetite. Silica grade and Iron recovery in the magnetite concentrate are the measured responses.

Example 1 - Effect of mixing two silica collectors

Contour plots are illustrative when evaluating the results of designed experiments. Below is the effect of mixing two silica collectors for reverse flotation of silica from magnetite illustrated; influence of dosage (g/ton) and collector composition. It is obvious that in this case there is an optimal ratio at about 30-40% of Comp#1 in Comp#2.

When several factors are investigated and the model is multi-dimensional DOE and MVDA becomes good tools for understanding and optimizing the system.

Example 2 - Influence of mechanical flotation factors

Rotor speed (Speed) and Airflow (Air) has been studied using two different collectors (Reag #A and #B).

The coefficient plot illustrates the influence of tested factors. The silica grade is affected most by the rotor speed; high speed gives increased silica grade in concentrate. The collector dosages are adjusted to give same silica grade, no influence on silica grade is therefore expected from the reagent coefficients. The airflow (in tested interval) has a negative minor effect on the silica grade, meaning that increased airflow reduces the silica content.

The iron recovery is negatively affected by both rotor speed and airflow, the collectors have opposite effect, #A gives higher iron recovery and #B lower.

Surface chemistry worldwide operations

Your responsive partner

Surface Chemistry, a business unit of AkzoNobel, operates in 50 countries, employing over 1500 people. Based in Chicago, IL, United States, we are a leading supplier of specialty surfactants and synthetic and bio-polymers additives. Using a combination of Chemical expertise, process technology and application know how, we solve problems for a multitude of manufactures and formulators. We service a wide range of industries including agro, asphalt, cleaning, fabric care, mining, personal care and petroleum. This map gives an overview of our main locations.
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**Surface chemistry worldwide operations**

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