



High-Efficiency Flotation Collectors for Magnetite Ores

SME Denver
February 2019

Nouryon

Agenda



Introduction to Nouryon



Iron Ore



High efficiency collector – Lilafлот 821M



Low toxicity collector – Armoflote 930



Conclusion

Nouryon – *Former AkzoNobel Specialty Chemicals*

Noury & Van der Lande

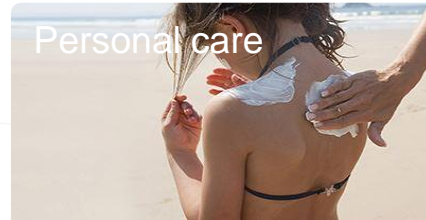
- Founded in 1838
- Pioneers in organic peroxides
- Realized the essential role chemistry could play in everyday life

Today we are still a world leader in essential chemistries used to manufacture everyday products



Supplying essential chemistry to markets worldwide

- Experts in highly demanding chemistry
- Supplying markets with essential chemicals for manufacturing everyday products
- Our products play an essential role in everyday life



Surface Chemistry Mining RD&I locations



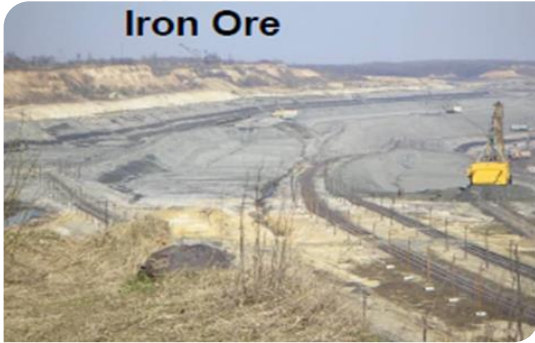
RD&I



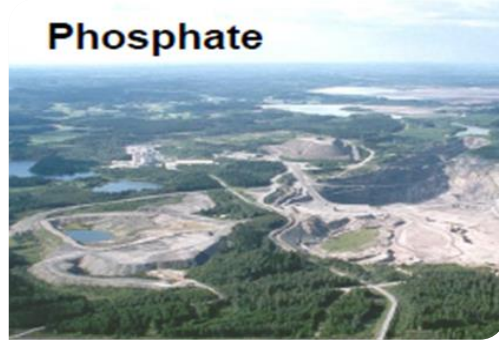
- Itupeva, Brazil
- Shanghai, China
- Mumbai, India
- Singapore
- Stenungsund, Sweden
- New York, US

Markets we serve – Main minerals

Iron Ore



Phosphate



Copper Sulfide



Calcite



Potash



Iron Ore (magnetite, hematite, itabarite)

End use

- Steel production

Quality requirement

- Low silica and low phosphorus content
- High Fe-grade

Nouryon expertise

- Reverse flotation
 - Removal of silicates
 - Process water with high content of electrolytes
 - Very fine particle size
 - Froth characteristic issues
 - Complex silicates
 - Removal of phosphate/apatite
 - Process water with high content of electrolytes



Agenda



Introduction to Nouryon



Iron Ore



High efficiency collector – Lilafлот 821M



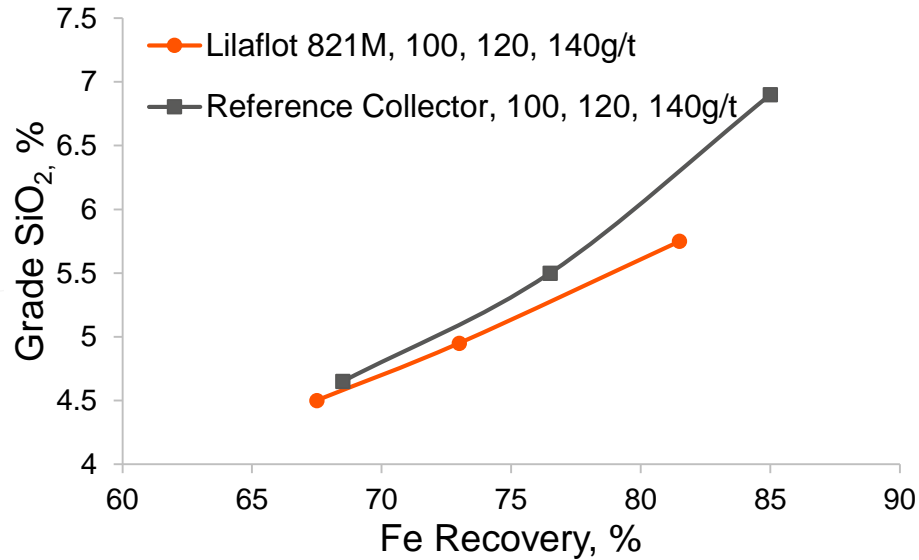
Low toxicity collector – Armoflote 930



Conclusion

Lilafлот 821M – lab results

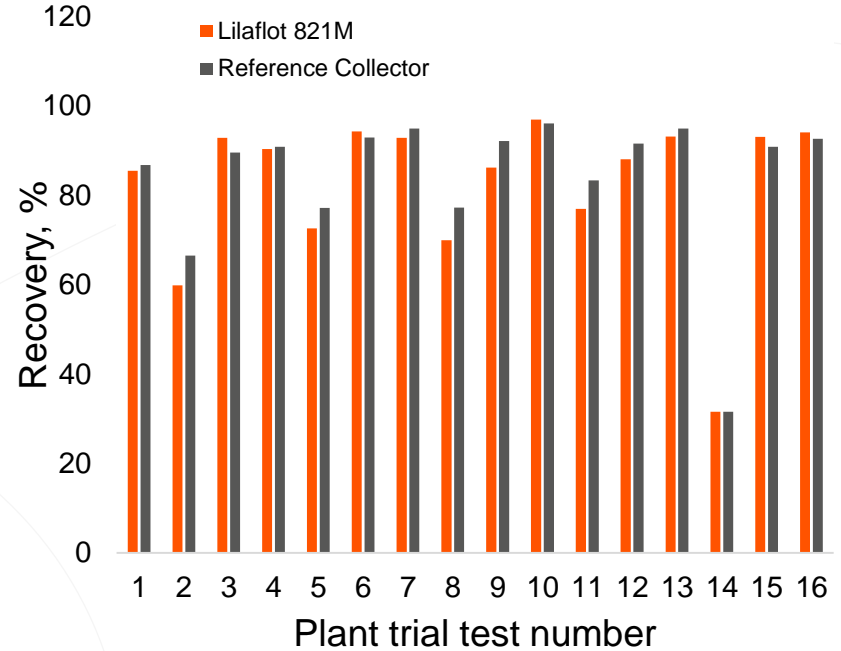
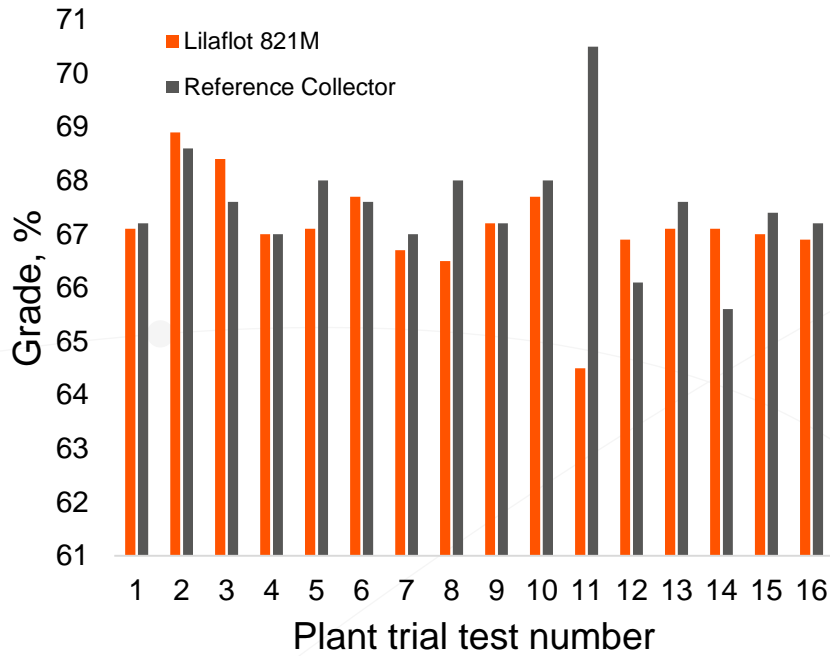
European Ore



	Reference Collector	Lilafлот 821M
Dosage		✓
Foaming		✓
Toxicity		✓

Lilafлот 821M – Plant Trial

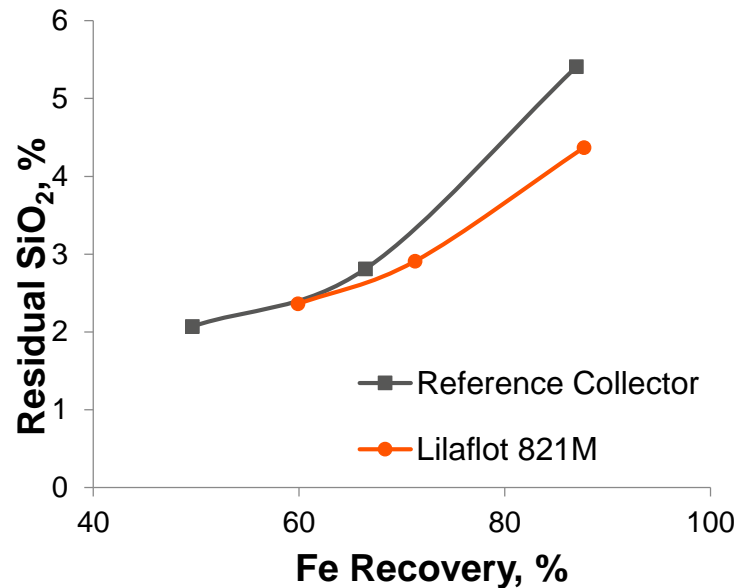
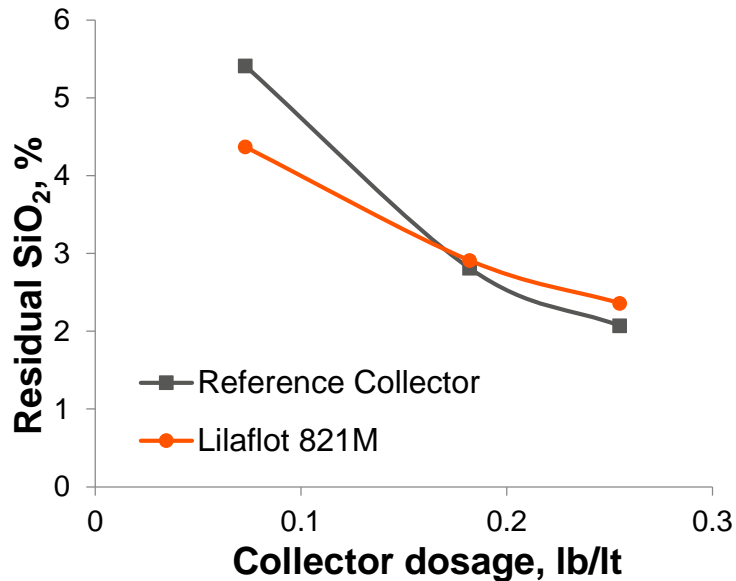
- The dosage of Lilafлот 821M was 50-80% of reference collector
- Good performance, similar grade and recovery



Lilafлот 821M – lab results - N.A. Ore 1

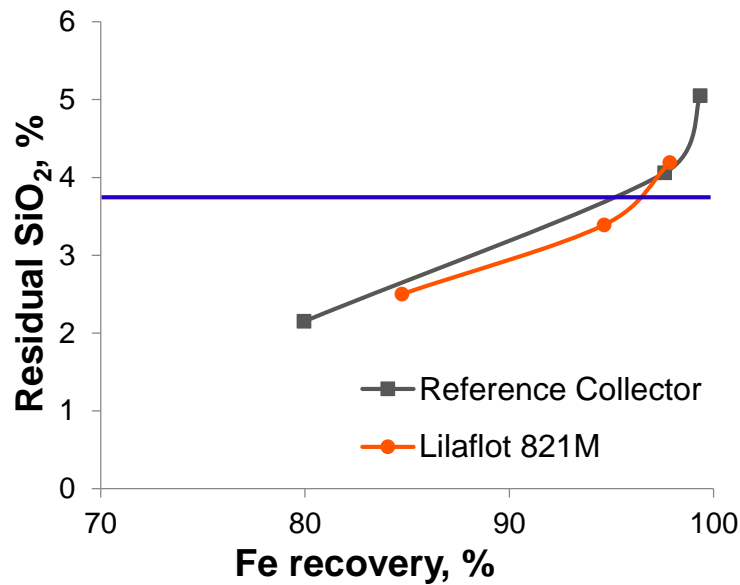
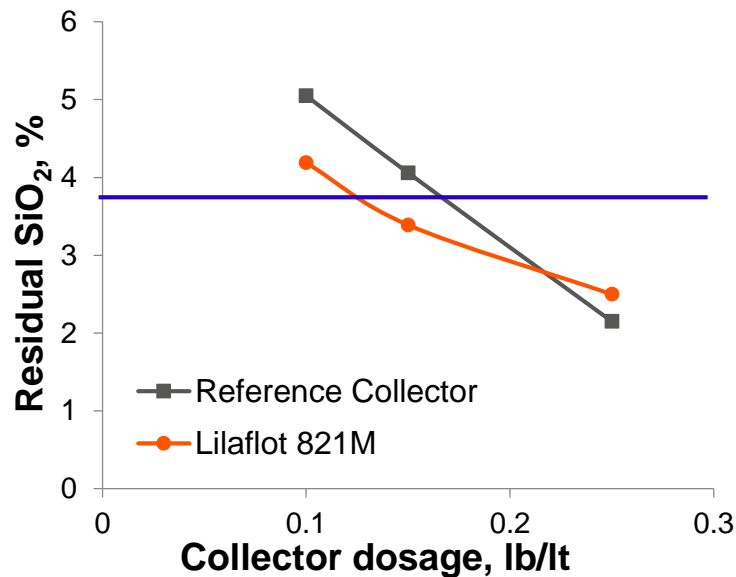
- Lilafлот 821M has higher dosage efficiency
- Lilafлот 821M provides better selectivity

N.A. Ore 1



- Lilafлот 821M needs lower dosage
- Lilafлот 821M provides better selectivity

N.A. Ore 2



Agenda



Introduction to Nouryon



Iron Ore



High efficiency collector – Lilafлот 821M



Low toxicity collector – Armoflote 930

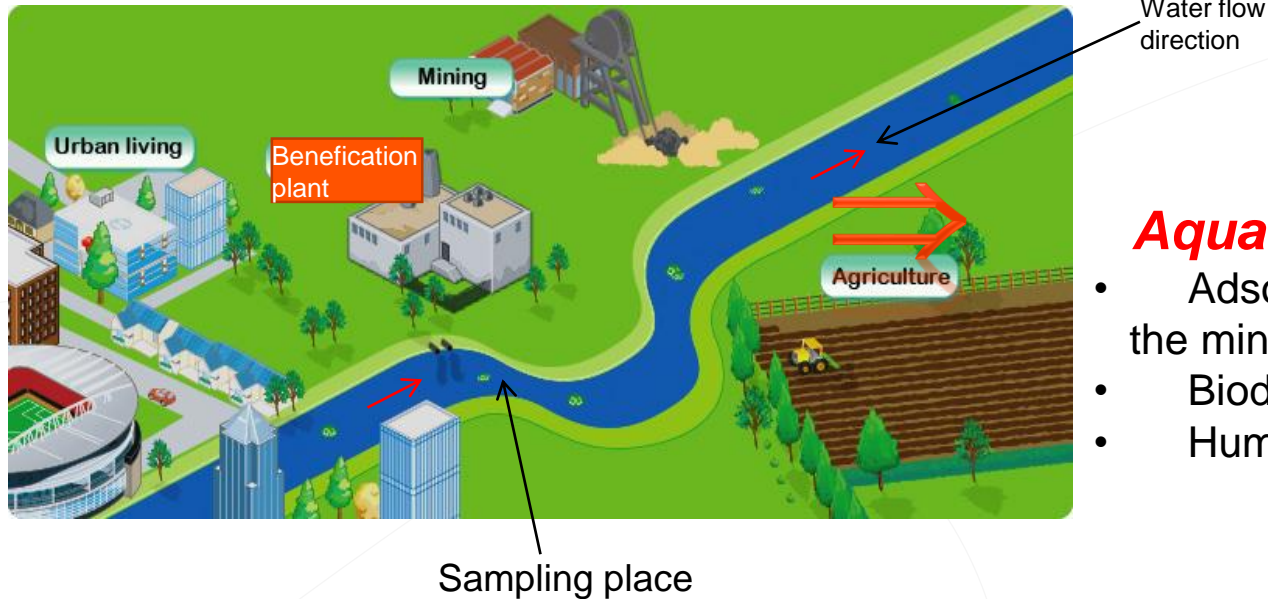


Conclusion

Permit to operate

Requirements of a collector

- Performance (grade, recovery, efficiency, froth stability)
- Operational permits connected to environmental profile of chemicals used in the flotation



Aquatic toxicity

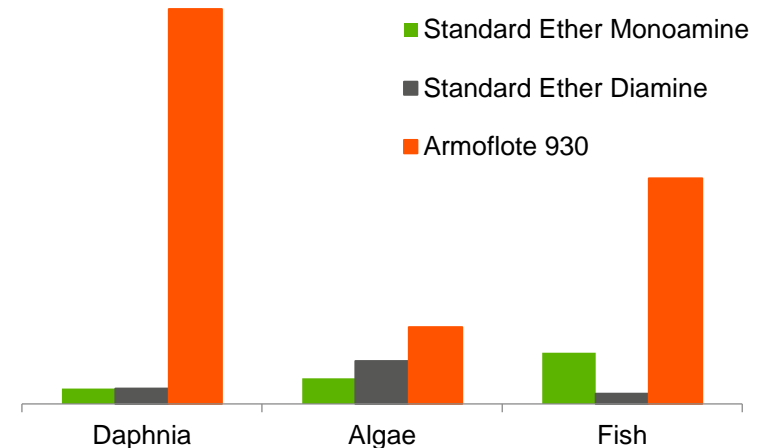
- Adsorption of the chemicals on the minerals - Bioavailability
- Biodegradability
- Human toxicity

Environmental Profile of Armoflote 930

Surfactant	% degradation in 28 days
Traditional Ether Monoamine	41
Traditional Ether Diamine	10
Armoflote 930	>60 = Readily Biodegradable



Toxicity (OECD) EC50/ErC50/LC 50, mg/l



*= predicted, read across.

- Higher value = less toxic surfactant
- Armoflote 930 25 times less toxic towards Daphnia
- Armoflote 930 1.8 times less toxic towards Algae
- Armoflote 930 22* times less toxic towards Fish

Environmental Benefits

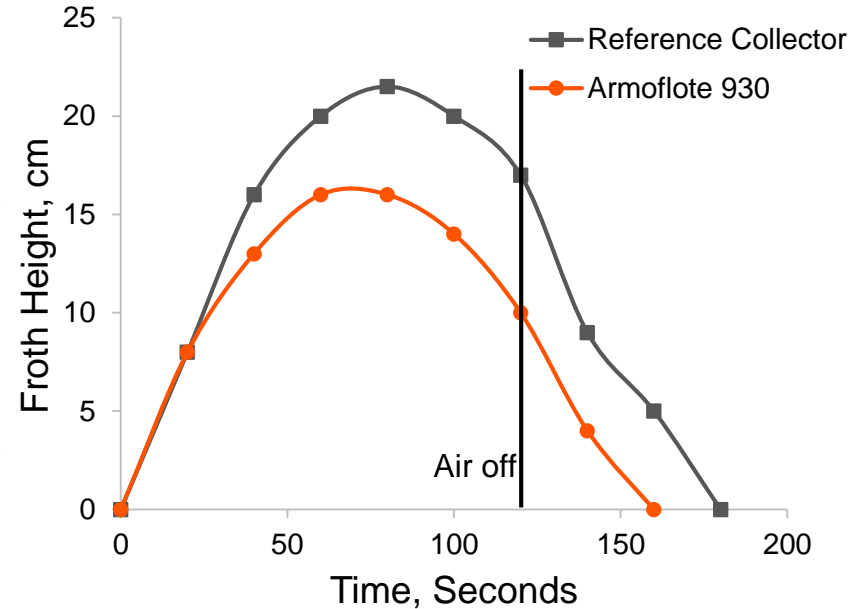
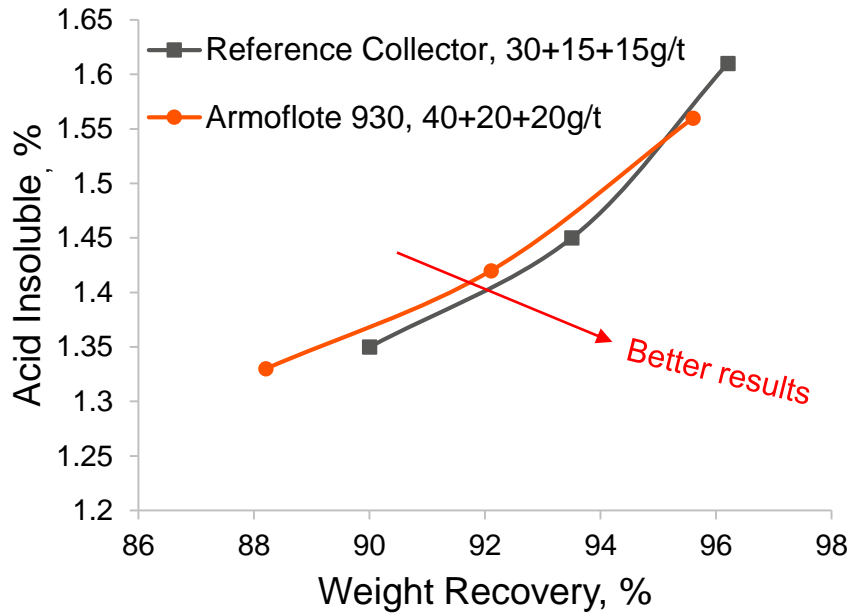
Environmental	Biodegradability	readily
	Aquatic toxicity (OECD algae)	0.75
	Human toxicity	Non toxic*
	Predicted No Effect Concentration	2-4 times higher

* predicted

- Aquatic toxicity of reference collector is 0.111.

Flotation Results & Frothing Properties

- Required grade and recovery in flotation obtained with our readily biodegradable & low toxicity collector Armoflote 930!
- Outstanding frothing compared to benchmark collectors obtained with Armoflote 930



Conclusion

- Lilafлот 821M
 - High efficiency
 - Better foaming
 - Less toxic to humans
- Armoflote 930
 - Low toxicity
 - Good performance
 - Outstanding frothing

***Your partner
in essential chemistry
for a sustainable future***



Thank you

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Nouryon

N.A. Ore 3

