JUNE 2023

SPARC
Strategic Projects and Advanced Research Centre

THE CREATIVE SPARC

inspire...innovate...ignite...

SPARC RECEIVES CRITICAL MINERALS GRANT

In our March newsletter, we mentioned that SPARC was submitting a grant application in the government's Critical Minerals Development Program. The program is designed to fund projects which increase the supply chain of critical minerals in Australia to further boost the economy in the renewable energy sector. I'm happy to say that SPARC was one of thirteen successful applications to receive funding for their proposed projects! Fellow awardees are the likes of Evolution Mining, Ecograf (with ANSTO), and IGO Ltd (a refinery partner of Andrew Forrest), which highlights the strength and competitiveness of the program.

Our project involves further development and commercialisation of lithium selective frother additive for spodumene ore processing. Currently, the refining of lithium from spodumene ore is roughly 85% efficient, meaning 15% of the lithium resides in the tailings, along with other valuable minerals. Our technology will improve the extraction efficiency to between 90 and 95%, giving a sizable boost to the lithium supply chain.

[continued below]

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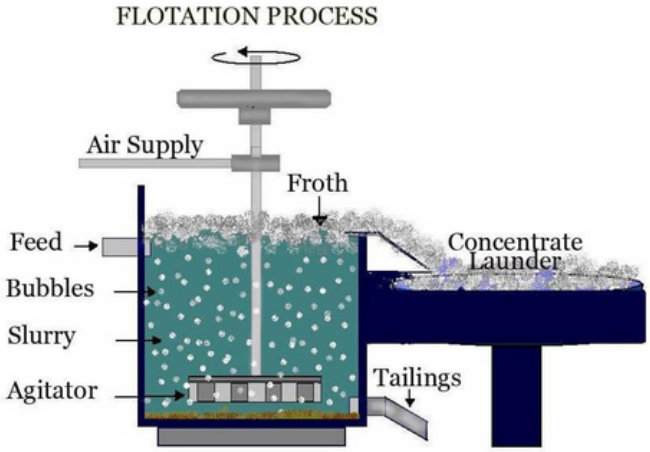
In order to take our technology to commercialisation, we're in partnership with Western Australia School of Mines (WASM) to conduct pilot frother studies as well as field studies to quantify the improvements in beneficiation of lithium extraction. Additionally, this system has the potential to be a platform technology, capable of use in other critical minerals and rare earth elements which undergo froth flotation separation techniques.

The economic benefits of this project are quite massive. Based on last years mining figures of 55 *kilotonnes* of lithium extracted, this technology could extract an extra 6 *kilotonnes* of lithium residing in the tailings, worth more than USD$400M - in Australia alone! Therefore, this could significantly add to the Australian economy and lithium supply chain. But there is much more than just an economic benefit to this technology, there is an environmental aspect as well.



Mining and mineral processing generates significant amounts of carbon dioxide, and other greenhouse gases, into the environment. And while it's unavoidable, it can be mitigated by improving the efficiencies of the processes involved in the extraction. According to estimates, 9 tonnes of CO_2 are generated for every tonne of lithium carbonate equivalent (LCE) refined. Roughly a third of this, 3 tonnes of CO_2, is due entirely to the mining and extraction process (here in Australia) not the shipping and reprocessing. So, by improving the extraction efficiency to increase the supply chain, this process would mitigate roughly 17 *kilotonnes of CO_2 per year* - the equivalent of removing 3700 cars from the road! While it's a drop in the ocean, it is a start.

SPARC'S LONG-TERM GOALS

Our vision is to "inspire and contribute towards a better world" - that means attacking head-on the big, hairy audacious goals (BHAGs) that will drive innovation. And in order to fulfill that vision we strive to grow and collaborate across multiple sectors and disciplines. Inspiration, many times, comes from cross-functional teams with wide-ranging backgrounds and expertise. This stimulates creativity and innovation.

We're already engaged with WASM, and we're developing a project with UNSW in the water treatment sector, but we're constantly looking for more opportunities to collaborate and grow, both externally and internally.

In the coming weeks, we'll be looking to hire a new researcher to join SPARC. Looking to increase our permanent staffing in the labs is a very exciting time, especially with the wealth of projects we currently have in our technology pipeline. Building the team to aid in these challenges is just the first step, there's many more on the horizon, and we'll be sure to inform you about our plans in the coming months. In the meatime, be on the lookout for the job posting soon!

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BIOADHESIVES AND HEALTHCARE SECTOR

Bioadhesives are an important material in the surgical field. While deep lacerations and cuts can be sutured or stapled together, this does present some issues. 'Field dressings', the need to rapidly stitch a wound to prevent bleeding for a given time, is near impossible and fine sutures during surgeries (such as heart and other vital organs) can create tissue damage and infection in delicate procedures.

Bioadhesives are biocompatible materials capable of quickly sealing a wound. Super or crazy glues are cyanoacrylate adhesives, and the biocompatible version of these is marketed as Dermabond. These compounds rapidly react with water to form a tight, polymer bond. If you've ever fused your fingers together using super glue, then you've felt their inherent strength (and need mineral spirits handy to remove it from your fingers!).

However, new research has been published using surface modified gelatin to create injectable hydrogel bioadhesives. Gelatin, just like the one used to make jellies and food preservatives, is derived from collagen - a natural biomaterial. When dried, it is a brittle translucent solid, but rubbery and pliable when swollen with water. It's this aspect which makes it a great hydrogel material. And when the surfaces of the gelatin particles used in the paper were modified with skin-binding chemicals, the researchers were able to generate a much more biocompatible and higher strength bioadhesive than the typical cyanoacrylates used thus far.

You may be wondering - interesting but what's the point? These materials can be formulated with additives such as anticoagulant, antibacterial, and tissue-growth stimulant materials just as easily as formulating a grease or lubricant material - harkening back to our Harrison Group expertise. In this instance, the research was doing surface modifications of the gelatin or chemically altering the exterior of the gelatin fibres to enhance binding to the skin. Again, this isn't much different to the chemistry that we're conducting in our bioderived EP additive project or the lithium selective frother. We're modifying those substrate materials to enhance binding interactions with target surfaces - whether metal gears and bearings or lithium ores. Moving forward, this will be a key area when we conduct projects in the healthcare space - modifying materials for specific responses...

QUOTE & FUN FACT

Teflon (polytetrafluoroethylene - PTFE) was 'discovered' in 1938, while working with TFE gas for new refrigerants. While this is one of the contributors to PFAS 'forever chemicals', it was instrumental in lubricating valves and fittings for the Manhattan Project, non-stick coatings, weather-resistant paints, and surgical catheters to prevent infections. Cross-discipline applications from a "failed" refrigerant gas experiment at DuPont labs.

"Creativity is inventing, experimenting, growing, taking risks, breaking rules, making mistakes, and having fun."
- Mary Lou Cook, American actress, singer, and dancer