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# Oxalate-associated challenges and solutions in Bayer processing

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## ABSTRACT

Alumina, the precursor to aluminium, is produced from bauxite ore through the Bayer process. Bauxite naturally contains organic material, which can result in sodium oxalate (oxalate) crystallising from Bayer liquor during the precipitation stage. Depending on the nature of this crystallisation, oxalate crystals can cause many problems which reduce the efficiency and profitability of an alumina refinery. Many methods have been developed to control oxalate crystallisation; however, these have been largely unsuccessful due to a lack of knowledge of how Bayer liquor impurities and conditions can reduce their effectiveness and influence oxalate crystallisation.

This research will present an overview of the oxalate-associated challenges observed across alumina refineries and their impacts on process operations. It will include an exploration of methods used to try to manage oxalate crystallisation within the Bayer process, establishing a deeper understanding of these by relating them to current theories of oxalate crystal nucleation and growth.

The use of additives is one approach to oxalate management that is easy to implement but has proven difficult to achieve desired results with. A methodology will be proposed to investigate the effects of additives on oxalate crystallisation, specifically morphology change. This will include a study of the impact of Bayer liquor parameters on additive effectiveness.

## KEY WORDS

oxalate, Bayer, crystallisation, additives, alumina

## **BIOGRAPHY**

Morgan Pettit-Granger is currently a PhD candidate at Queensland University of Technology (QUT), where she studies sodium oxalate crystallisation in Bayer processing. She graduated with first-class honours in a Bachelor of Chemical Engineering from QUT in 2023 and began her PhD studies in 2024.

During the final year of her undergraduate degree, Morgan conducted research for Rio Tinto Aluminium, focusing on hydrate particle morphology. After graduating, she worked for three months at Rio Tinto's Queensland Research and Development Centre at the Yarwun Alumina Refinery. During this time, she deepened her understanding of refinery processes and operations, as well as laboratory procedures and safety protocols.

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