

Techno-economic analysis and life cycle assessment of cellulose nanocrystal production

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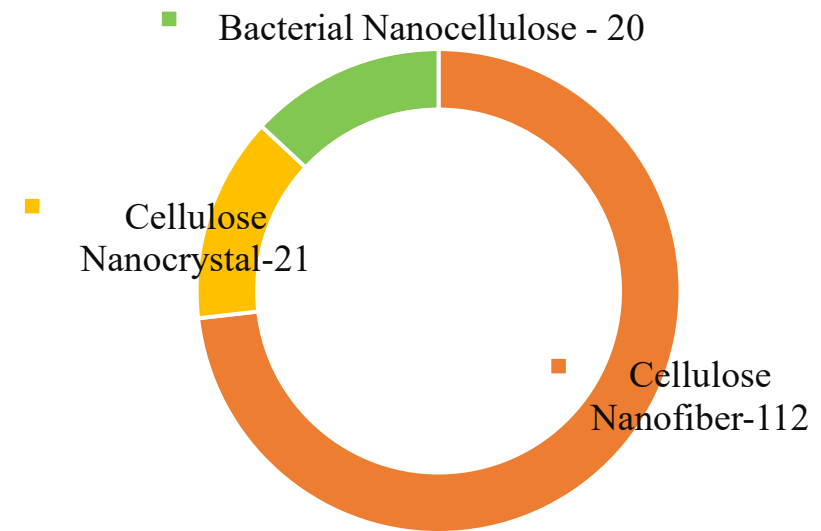
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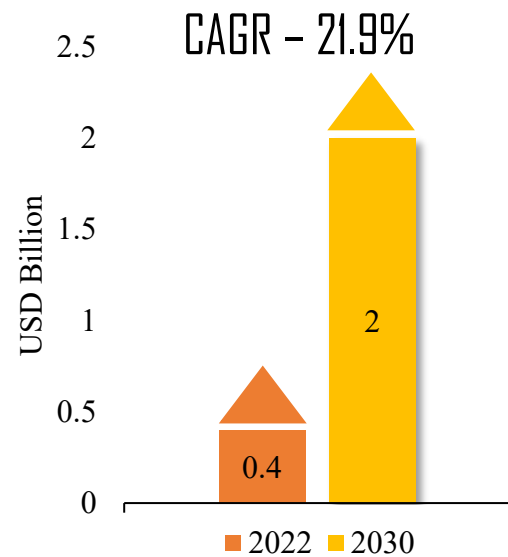
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Cellulose Nanomaterials – Global Companies



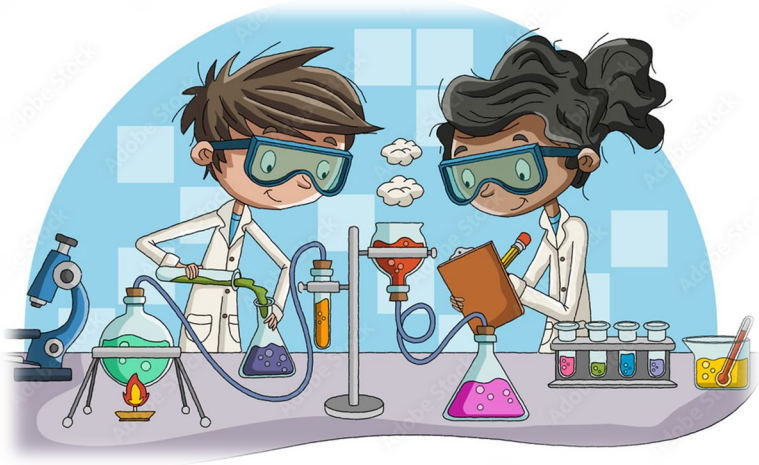
Global CNMs Companies (Future Markets, 2023)



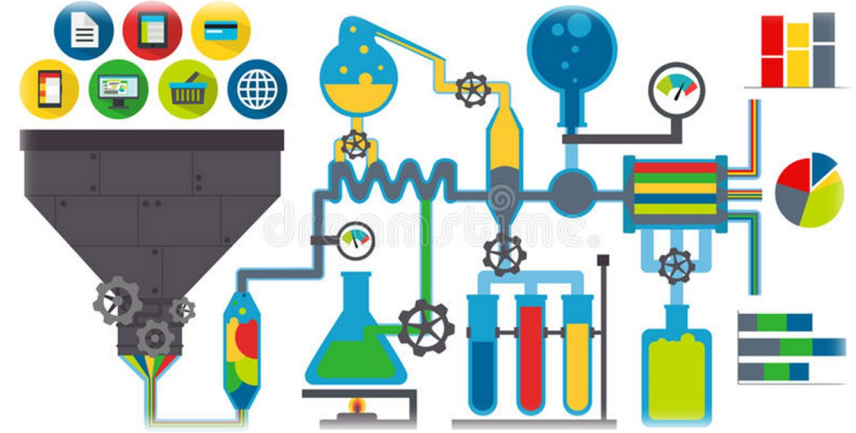
Global Market Size (2022 – 2030)

Source: <https://www.marketsandmarkets.com/Market-Reports/nano-cellulose-market-56392090.html>

Importance of Techno-economic analysis and Life-cycle assessment



Step -1: Lab-scale Research



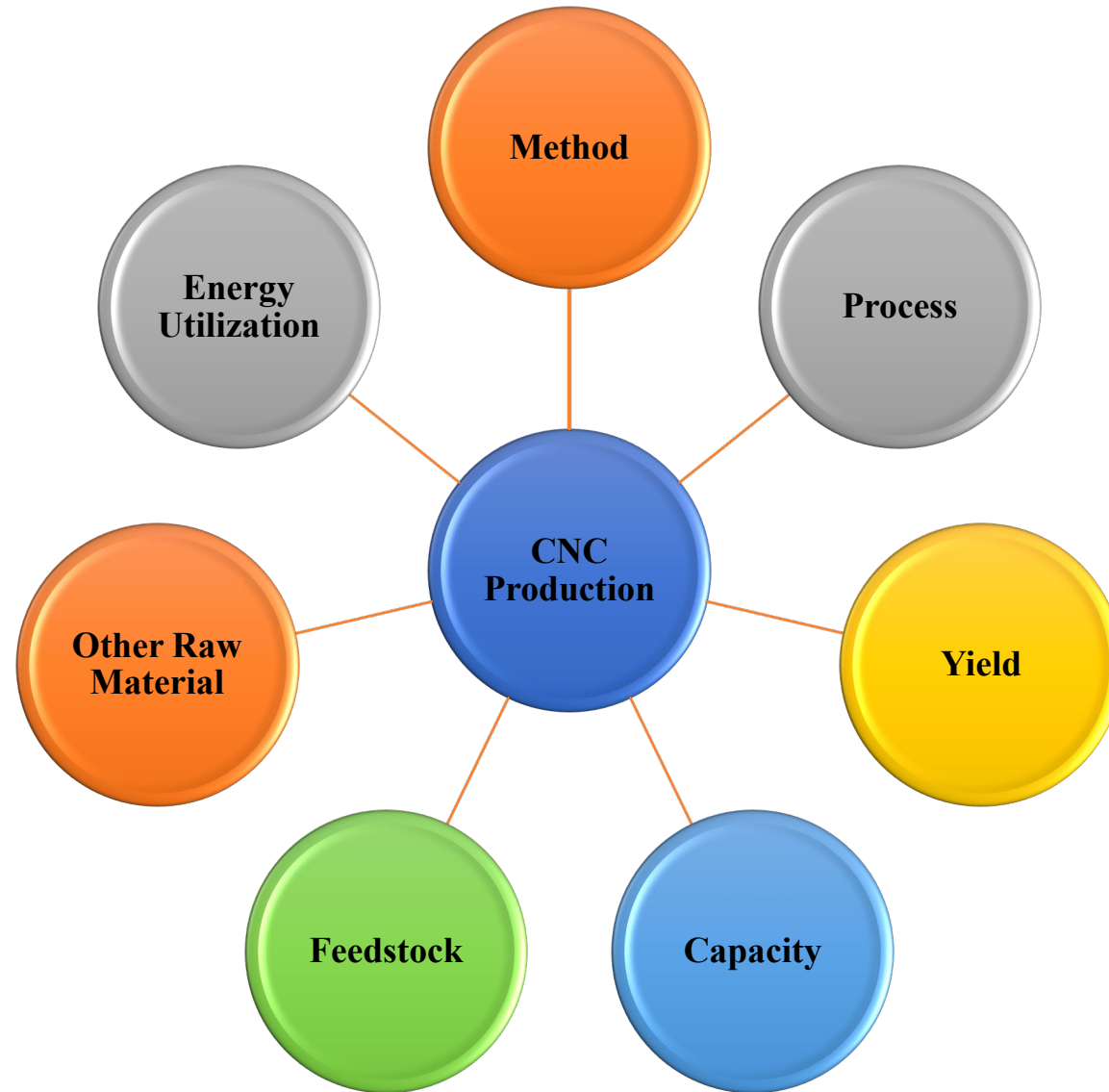
Step -2: Pilot Plant development



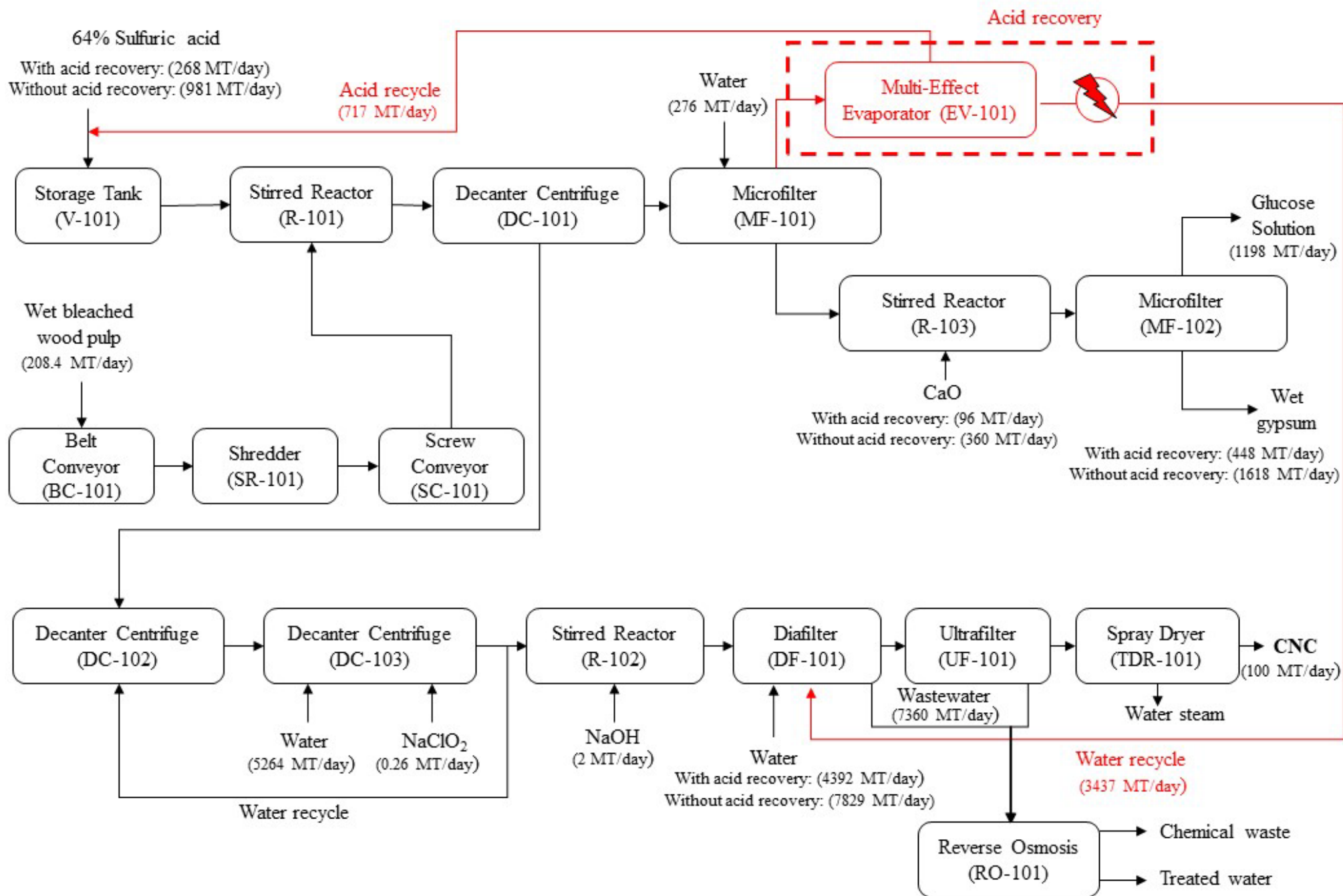
Step -3: Industrial Development

- Techno-economic analysis (TEA) has been considered an important tool to evaluate the economic performance of industrial processes.
- Recently, the application of TEA has been observed to have exponential growth due to the increasing competition among businesses across various industries.
- TEA helps to determine the economic feasibility and minimum selling price of cellulose nanomaterials.
- In the application area, TEA helps identify the economic implications of CNM-based products.
- Life Cycle Assessment (LCA) aims to quantify the environmental impacts that arise from material inputs and outputs, such as energy use or air emissions, over a product's entire life cycle to assist consumers in making decisions that will benefit the environment.
- LCA helps to determine the environmental impact of the CNM production process and its applications.
- TEA and LCA are necessary tools to take a novel lab-scale process to pilot scale or industrial scale.

Major Economic and Environmental Factors in Cellulose Nanocrystal



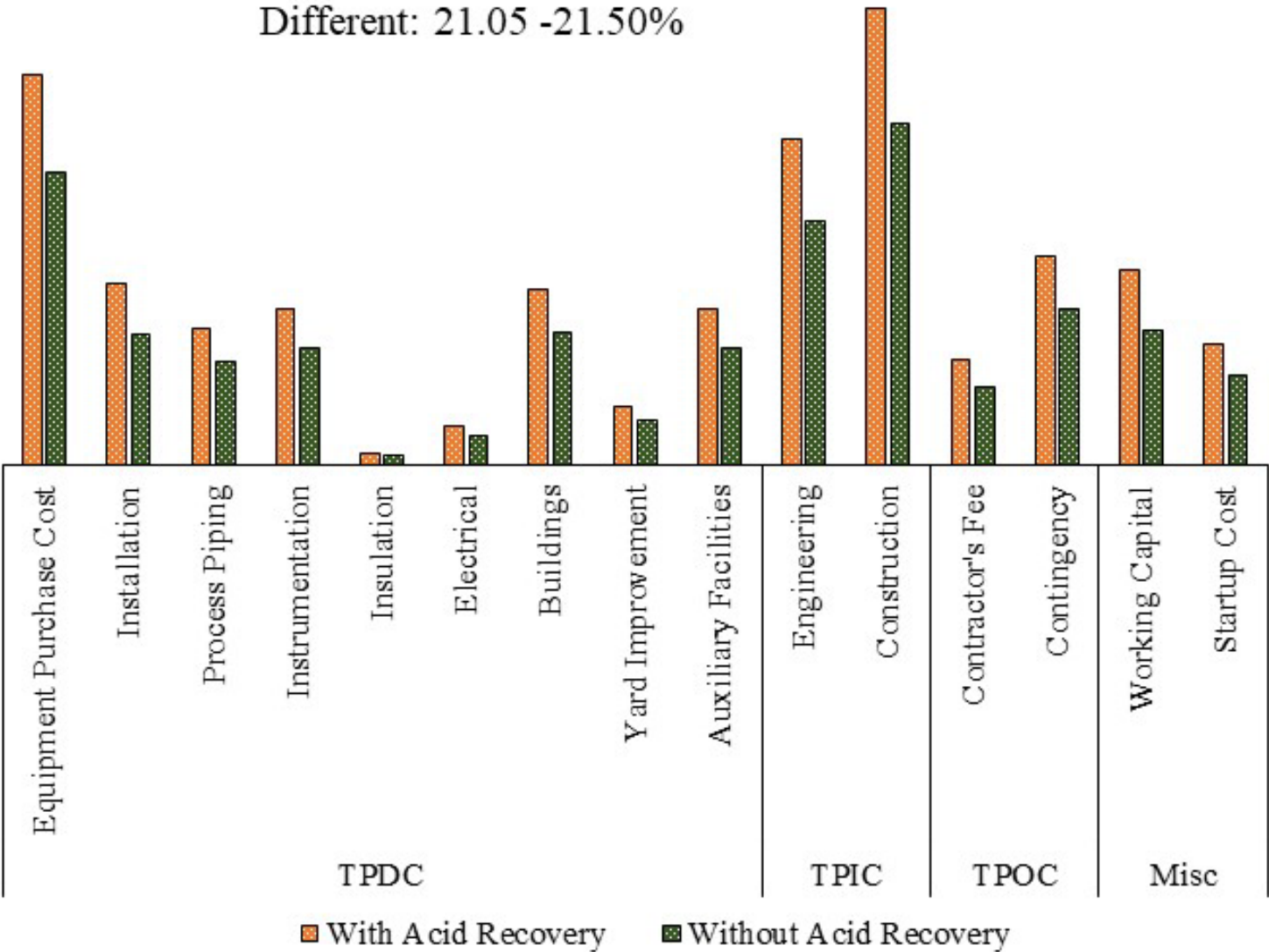
Process Flow Diagram



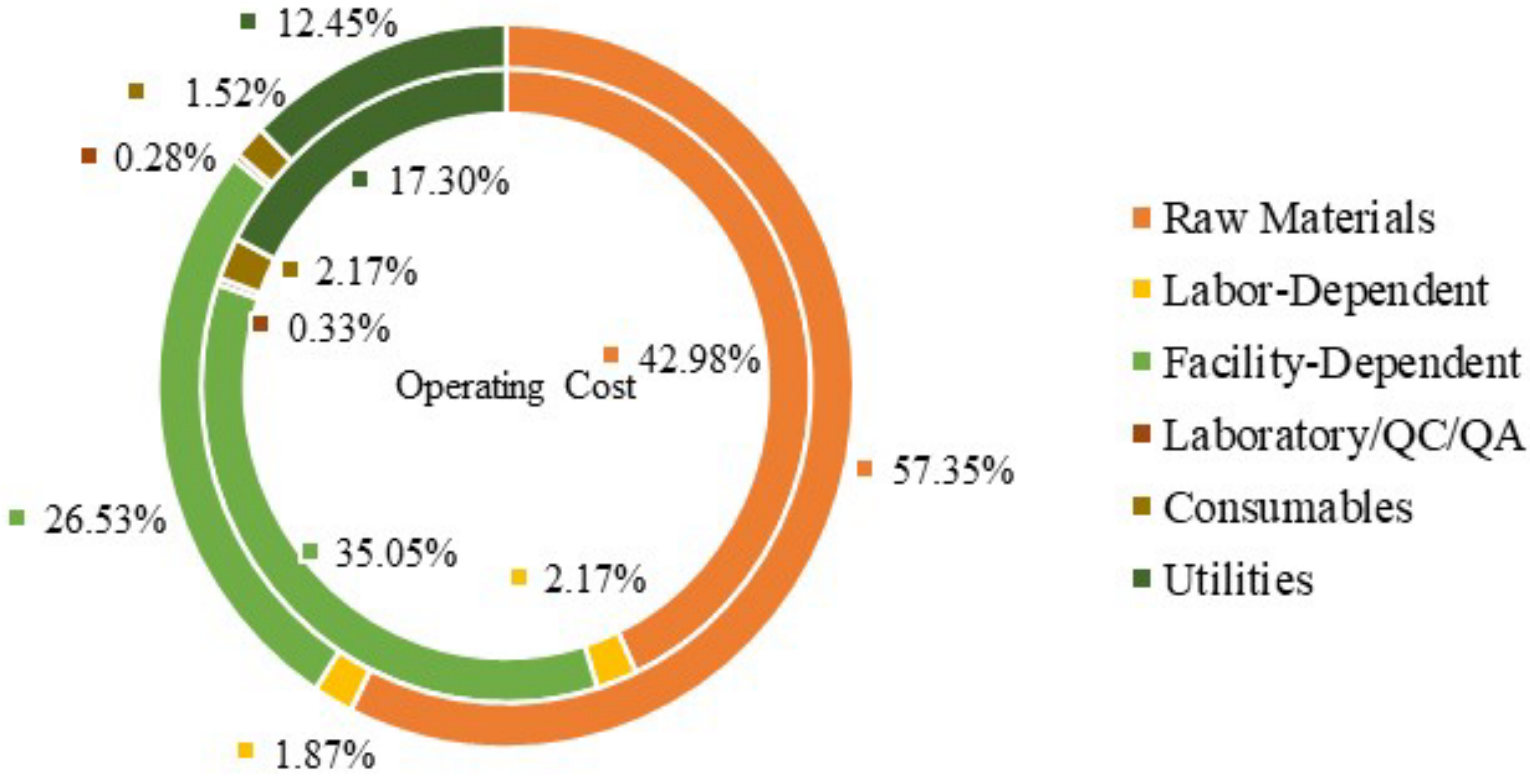
Note: The red line flow applies only to the acid recovery process

Note: The capacity was assumed in this study (100 MT/day)

Capital Investment

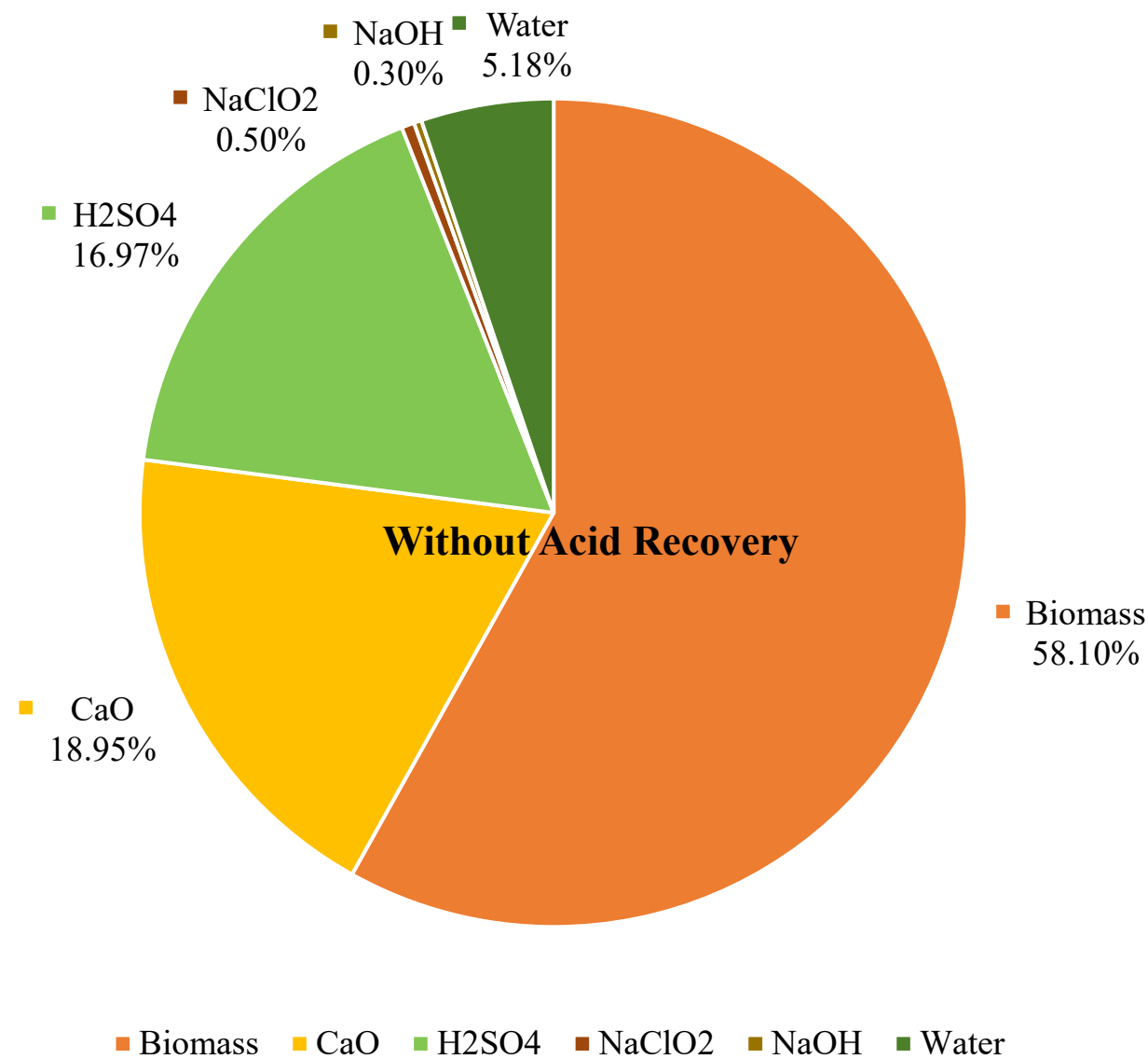
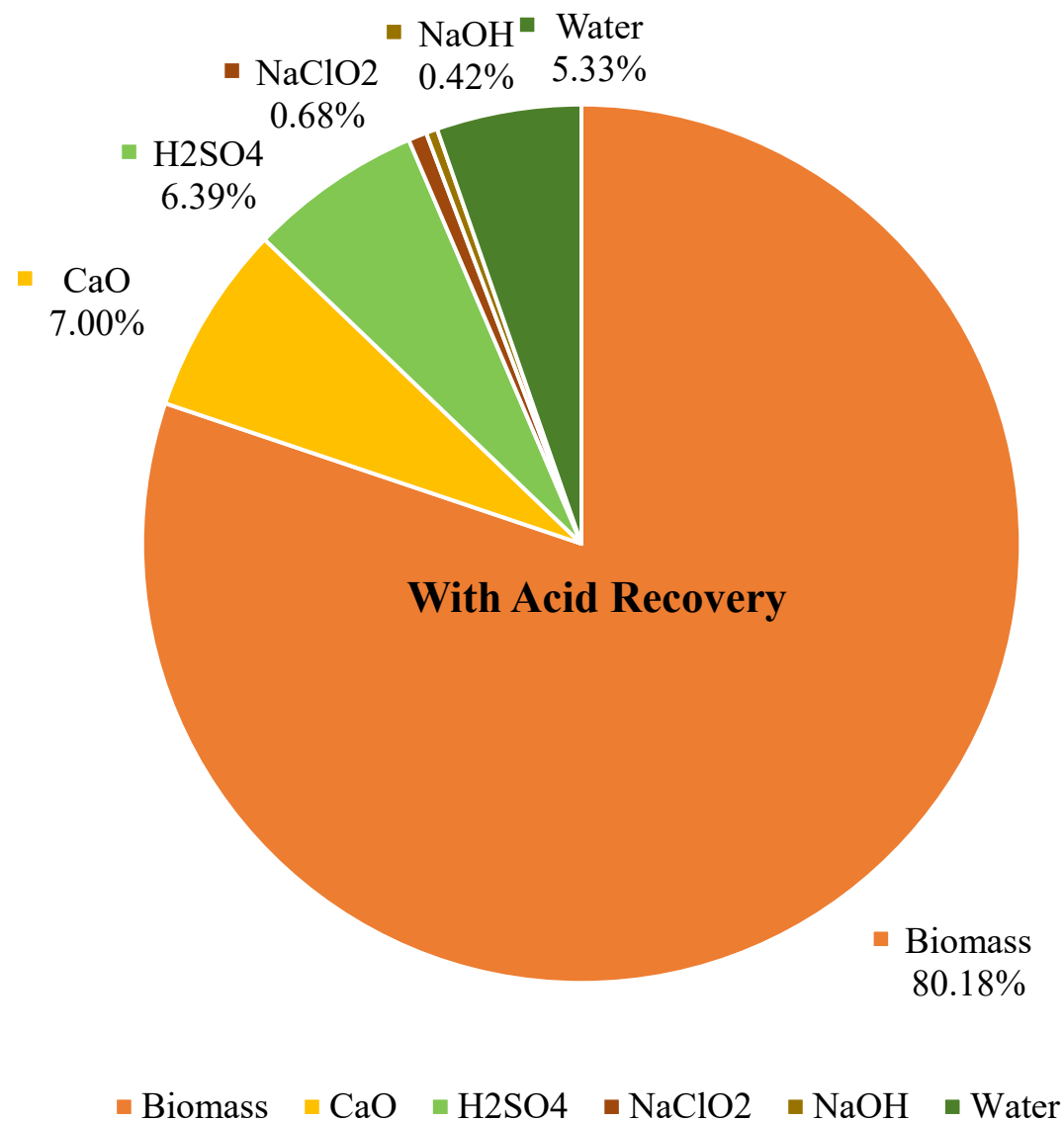


Operating Cost

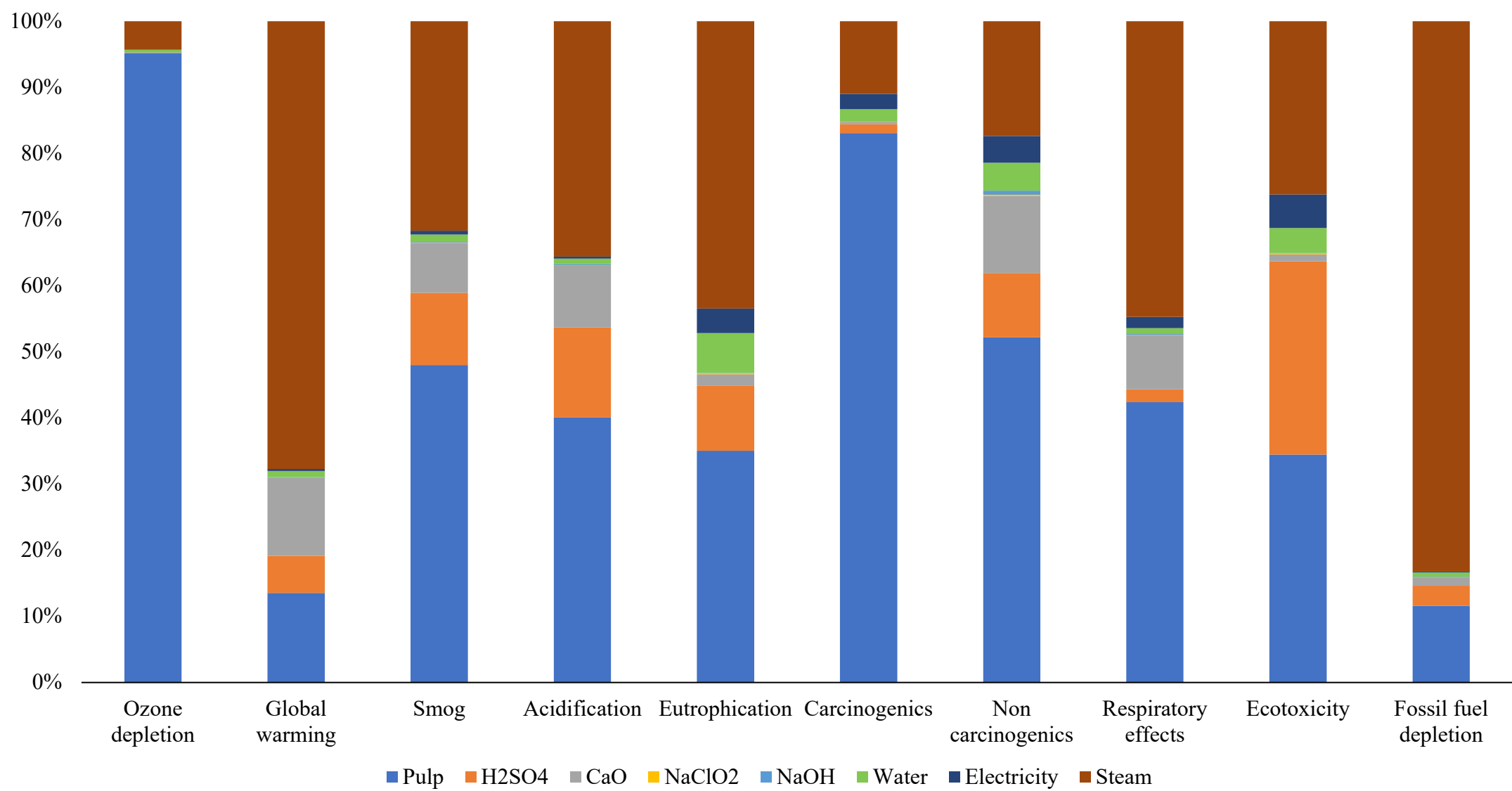


Inner Ring: With Acid Recovery / Outer Ring: Without Acid Recovery

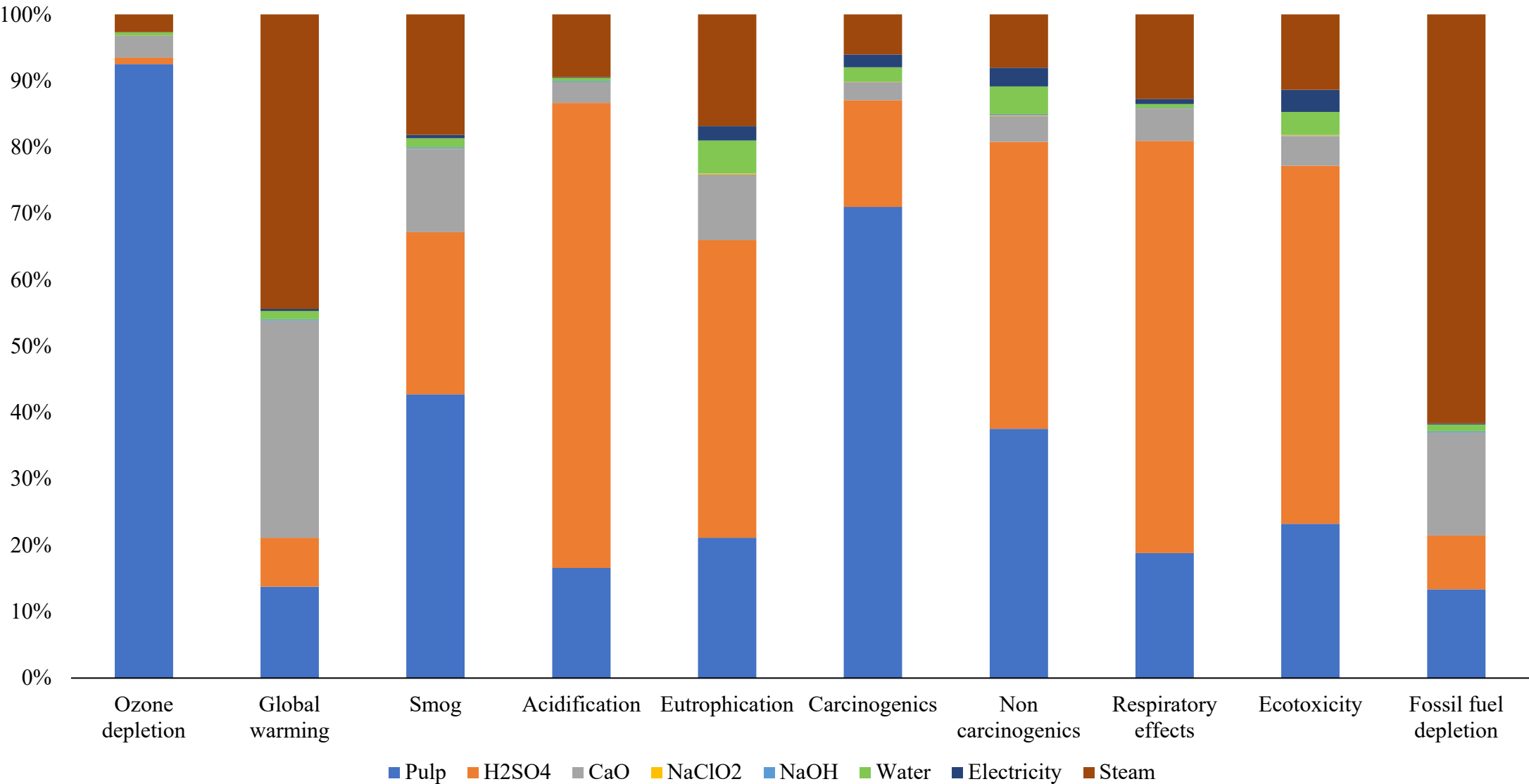
Raw Material Utilization



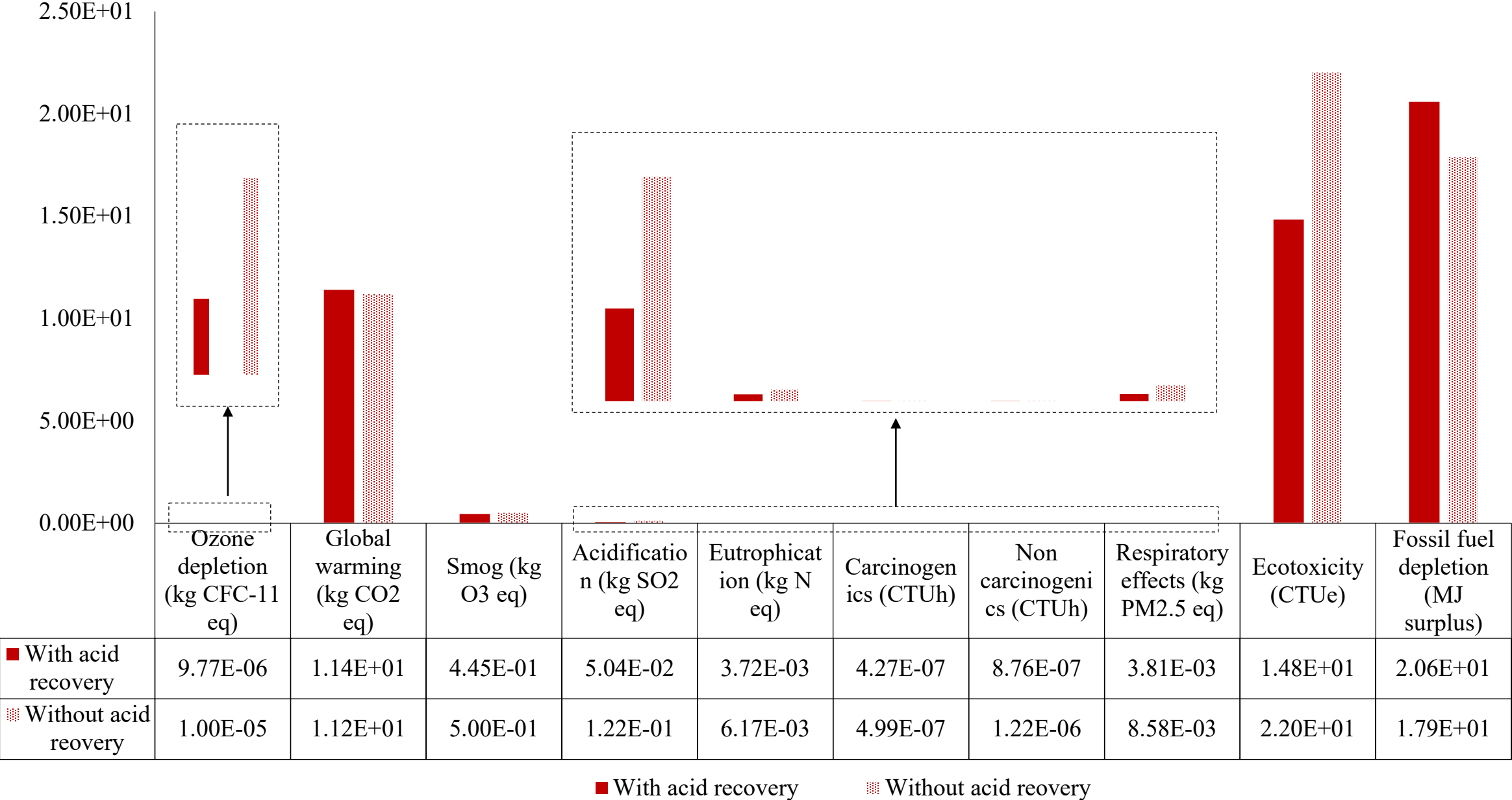
Life Cycle Assessment – With Acid Recovery



Life Cycle Assessment – Without Acid Recovery



Life Cycle Assessment



Publication

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