Plant based coagulants in Brazil – a proposal per biome

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Highlights:

- Nature-based solutions are needed in water treatment.
- Exploring natural coagulants in Brazil: a detailed thematic map.
- Preparing natural coagulants: potential for replication on a household scale.

Keywords: Plant-based coagulants; Nature-based solutions; Biomes.

INTRODUCTION

Coagulants play a crucial role in water treatment, being a viable solution for application in decentralized points. However, it is essential to recognize that conventional coagulants can lead to significant adverse effects, with potential impacts on human health and the environment.

Considering the urgency of finding nature-based solutions to address contemporary environmental challenges, it is necessary to adopt the use of plant-based coagulants as alternatives to chemical coagulants [1].

Plants with coagulant properties are dispersed throughout the Brazilian territory. The different biomes, representative of biological and geographical communities, assist in the search for these coagulants, each adapted to its specific climatic conditions and local diversity.

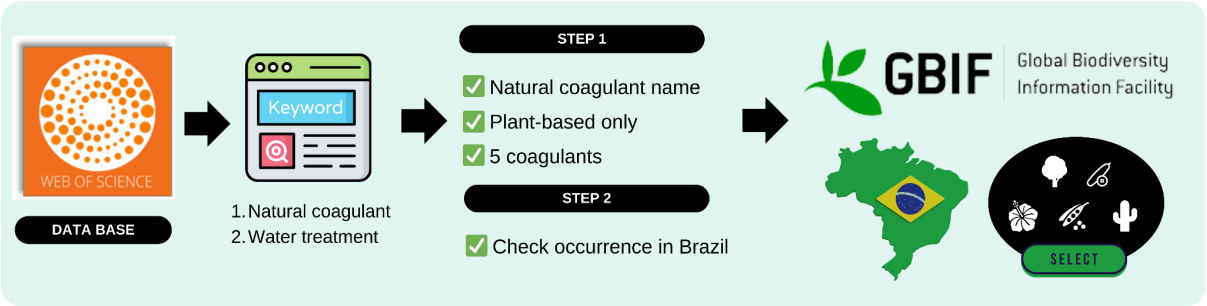
This expanded abstract reviewed the literature on natural coagulants, identifying the Brazilian biomes in which they occur and the preparation method of the coagulant. Finally, a thematic map was presented to guide future research and users on which plant-based coagulants may be further explored by biome.

METHODOLOGY

From the Web of Science database, a search was conducted using the keywords natural coagulant and "water treatment", filtering only review articles. The literature found was organized by title, keywords, DOI, abstract and year of publication using Microsoft Excel. From the articles selected, the names of the natural coagulants were extracted, and then only those based on plants were chosen. Next, the 5 most frequent coagulants in the selection were searched for on the GBIF platform - The Global Biodiversity Information Facility, and if the plant from which the coagulant came did not occur in Brazil, it was excluded.

Finally, with the assistance of the QGIS georeferencing system, it was possible to import all occurrences of the plants that are coagulants into the Brazilian territory, allowing for a comparison of their distribution with the biomes in the country (Figure 01).

Figure 01: Methodology visual abstract.



RESULTS AND CONCLUSIONS

Analysis of the database showed 111 natural coagulants in the 73 articles filtered. Among them, *Moringa oleifera* (white acacia) was the most cited (9.68%), *Abelmoschus esculentus* (okra) at 4.15% and *Opuntia ficus-indica* (cactus), *Hibiscus sabdariffa* (hibiscus) and *Acacia mearnsii* (tannin) at 2.30% each. Based on these results, Figure 02 was prepared, showing the 5 most mentioned natural coagulants and their occurrence in Brazilian biomes, as well as the methods of preparation.

Figure 02 highlighted that *Hibiscus sabdariffa* is the most widely distributed natural coagulant in Brazil and its biomes. *Moringa oleifera* was also widely recorded in all biomes except the Pampa. *Acacia mearnsii* was only registered in the Mata Atlântica and the Pampa. *Opuntia ficus-indica* was observed in all biomes except the Pantanal. Finally, *Abelmoschus esculentus* occurred in all Brazilian biomes except the Pantanal.

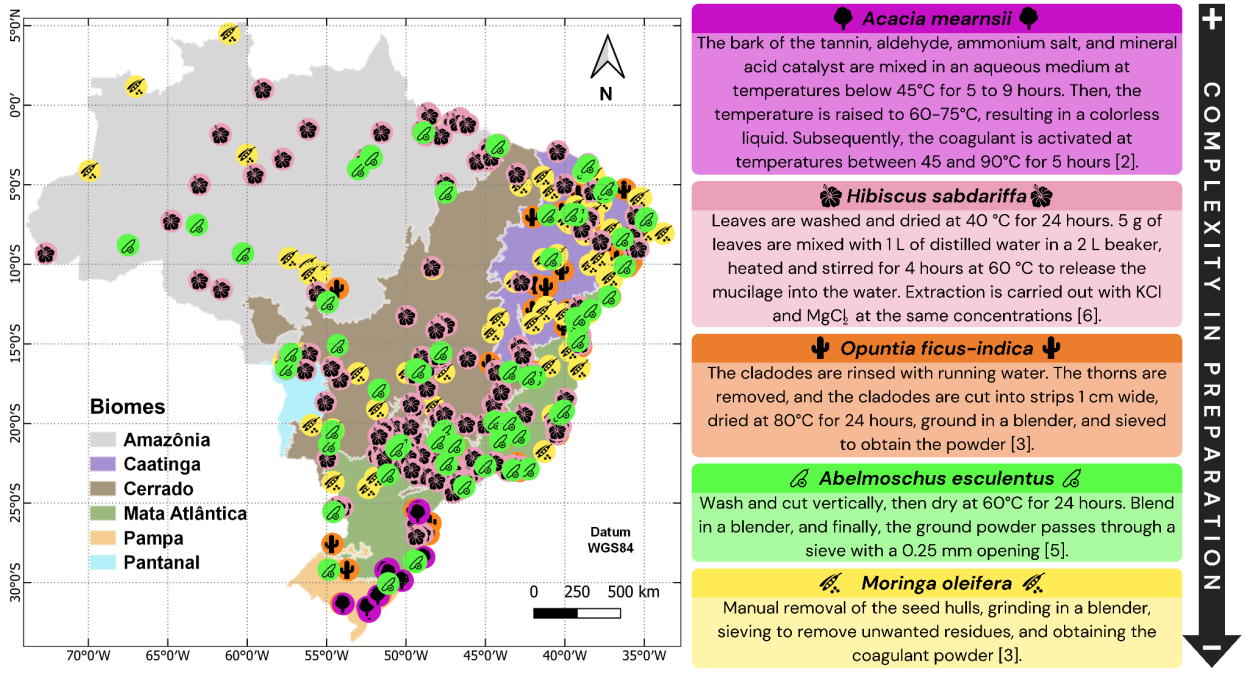
Based on the occurrence count on the GBIF platform, a predominance of certain coagulants in each biome was observed. In the Pantanal, Cerrado, and Mata Atlântica, hibiscus and drumstick tree stand out; in the Caatinga, drumstick tree and prickly pear cactus; in the Amazônia, okra and hibiscus; and in the Pampa, prickly pear cactus and black wattle.

The data obtained from the GBIF platform came from records and observations by users of the platform. Since the hibiscus has a showy flower, it could potentially lead to more records. However, the presence of a record of a plant indicates that it thrives in certain conditions, which is the focus of this extended abstract.

After analyzing the database, it was found that the preparation methods for some coagulants are more complex than others, requiring laboratory materials and equipment, while others can be prepared by users on a domestic scale. Figure 02 presented in this summary shows the preparation methods, from the most complex to the simplest, indicating that this alternative can be viable depending on the coagulant chosen and its spatial distribution in Brazil.

The distribution of coagulants on the map provided a viable alternative for individuals residing in rural communities to select the most suitable coagulant for the biome they are in, as well as assisting future research. By adapting to local conditions, these coagulants meet the specific needs of each community. Additionally, the preparation of these coagulants was investigated with the aim of making water treatment accessible and replicable for future users.

Figure 02: Thematic map of plants with the potential to be natural coagulants by biome and a table with their respective preparation methods.



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