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The use of plant-derived biomaterials as drug formulation excipients: an application of biomimetics in dosage form development

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Introduction

To develop an active drug into a suitable dosage form, pharmaceutical scientists combine various excipients (additives) obtained from different sources. Considering the trends of advancements in the field of biomimetics, we hypothesize that biomaterials contained in different plant parts have inherent biological properties that can mimic what is desired of a drug excipient. In this project, the researchers explore a range of plant-derived constituents and analyse them towards optimising their use as pharmaceutical excipients in dosage form development.

Research Approach

A range of desired pharmaceutical product qualities was selected to be the focus of the study. Following this, a comprehensive literature survey is being carried out to identify plants and herb-parts with documented records of possessing these desired traits in their composition and biological activity. Availability of these plant parts in Africa is also being considered. The identified plant parts will be collected after which the constituents of interest will be extracted from them. These constituents will be characterised and optimised for prospects of enhancing pharmaceutical formulations, leveraging on their natural pathways of activity.

Progress Made

So far, ten (10) biomolecules of interest have been identified for their potential as versatile pharmaceutical additives (Table 1.0). The plant parts bearing these molecules are currently being collected and identified from different regions of Africa, predominantly from Nigeria (in West Africa) and across South Africa. At the completion of this collection phase, these plant parts will be subjected to careful extraction processes to obtain the target biomolecules without denaturing them. The biomolecules will thereafter be integrated into the formulation components of different dosage forms and drug delivery systems where they will be expected to elicit their inherent biomimetic attributes towards enhancing the pharmaceutical features of these test formulations.

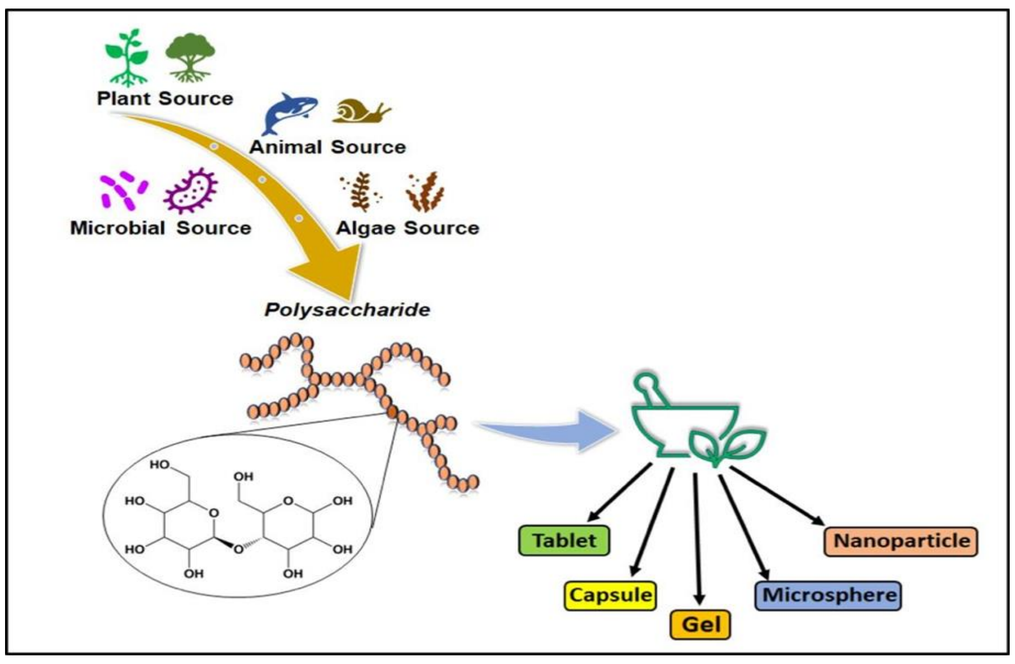

Figure 1: A schematic representation of the research approach

Table 1: Biomolecules of interest for the exploration of biomimetic applications in test pharmaceutical formulations

S/N	Biomolecules	Plant source	Plant parts of interest	Functional (inherent) dosage form properties	Applicable pharmaceutical dosage form
1.	**Cellulose hydroxypropyl methyl cellulose (HPMC)**	Cotton, flax, jute, hemp	Stem, leaves, seeds, fruits, flowers	Diluent/binder, solubility, controlled release of drugs, thickening	Solid (tablets) and semi-solid dosage forms
2	**Starch**	Maize, yam, wheat, potatoes, rice	Seeds, roots	Thickening, solubility, gelling agent, foaming, Binder, control release, stabilizer	Tablets, nanoparticles, topical dosage form (talc-dusting powder)
3	**Pectin**	Apple, citrus	Fruits	Rapid solubility and disintegration, coating agent	Film dosage forms for oral cavity, dispersible tablets, soluble tablets, film coated tablets
4	**Gum Arabic/Gum Arabica**	*Acacia senegal, Acacia seyal*	Branch, trunk	Suspending agents, emulsifier, binder, gelling agent, mucoadhension, encapsulation	Tablets, emulsion, suspension, emollients, targeted drug delivery systems
5	**Guar gum**	*Cyamopsis tetragonolobus*	Seeds	Thickener, emulsifier, stabilizer, binder, flocculating agent	Controlled-release drug delivery systems (extended-release tablets, emulsion, suspension)
6	**Karaya gum**	*Sterculia urens*	Branch, trunk	Stabilizers, emulsifying agent, binder	Floating drug delivery systems (microbeads, tablets), sustained-release dosage forms (tablets, powders), hydrogels
7	**Inulin**	Garlic, onions, wheat	Roots	Taste enhancer, stabilizer	Colon-targeted drug delivery system
8	**Xyloglucan**	Tamarind trees	Seeds	Mucoadhesive and film-forming properties	Nanoparticles, hydrogel, matrix tablets, films
9	**Beta-glucan**	Barley and oat	Seeds	Thickening and stabilizing agent	Parenteral solution, cream, paste, emollient
10	**Exosome**	Grape, tomatoes, grapefruits, ginger	Fruits	Targeting ligands for site-specific drug delivery.	Parenteral solutions, aerosols, nanoparticles

Conclusion

Driven by the possibility of having plant constituents replicate their biological characteristics upon incorporation in pharmaceutical dosage forms, this study expects to generate usable biomimetic-derived drug excipients in a bid to make final pharmaceutical products more affordable and therapeutically effective.

References

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