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Review

A review on challenges and issues with carboxymethylation of natural gums: The widely used excipients for conventional and novel dosage forms

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ABSTRACT

Diverse properties of natural gums have made them quite useful for various pharmaceutical applications. However, they suffer from various problems, including unregulated hydration rates, microbial degradation, and decline in viscosity during warehousing. Among various chemical procedures for modification of gums, carboxymethylation has been widely studied due to its simplicity and efficiency. Despite the availability of numerous research articles on natural gums and their uses, a comprehensive review on carboxymethylation of natural gums and their applications in the pharmaceutical and other biomedical fields is not published until now. This review outlines the classification of gums and their derivatization methods. Further, we have discussed various techniques of carboxymethylation, process of determination of degree of substitution, and functionalization pattern of substituted gums. Detailed information about the application of carboxymethyl gums as drug delivery carriers has been described. The article also gives a brief account on tissue engineering and cell delivery potential of carboxymethylated gums.

1. Introduction

Over the last two decades, the natural and modified polysaccharides have been extensively studied as pharmaceutical excipients as well as for their prospective applications in drug delivery and biomedical engineering. Biomimetic and intelligent drug delivery methods, tissue engineering scaffolds, and nanotheranostic materials have all received more attention. In nature, higher plants typically include polysaccharide hydrocolloids such as mucilage, gums, and glucans. Because of their structurally diversified class of biological macromolecules with a wide range of physicochemical properties, these polysaccharide hydrocolloids have found widespread use in pharmacy and medicine [1]. Diverse properties of "Natural Gums" have made them quite useful for various pharmaceutical applications. They are utilized as binding and disintegrating agents in solid dosage forms. They are also utilized as stabilizing, thickening and suspending agents in oral, liquid and topical formulations. Since natural gums are non-toxic, cheaper and easily available, they are more preferred over synthetic materials. In the form of per-oral drug delivery carriers food additives or per-oral drug delivery carriers, the consumption of most of the natural gums has been recognized as safe [2–5].

Natural gums also suffer from various disadvantages including uncontrolled rate of hydration, susceptible to enzymatic degradation, thickening, and drop in viscosity on storage, and microbial contamination, which limits their application in controlled drug delivery [6]. In order to make them suitable for designing specific drug delivery systems, these drawbacks need to be overcome. The polysaccharides possess a number of functional groups amenable for chemical modification or conjugation with other materials. Thus, the structural modifications open up the possibility of obtaining some desirable physicochemical properties for the design of drug delivery carriers and tissue engineering scaffolds [7]. The non-ionic polysaccharides can be imparted ionic characteristics via suitable chemical modifications of their existing functional groups. Carboxymethylation represents such a

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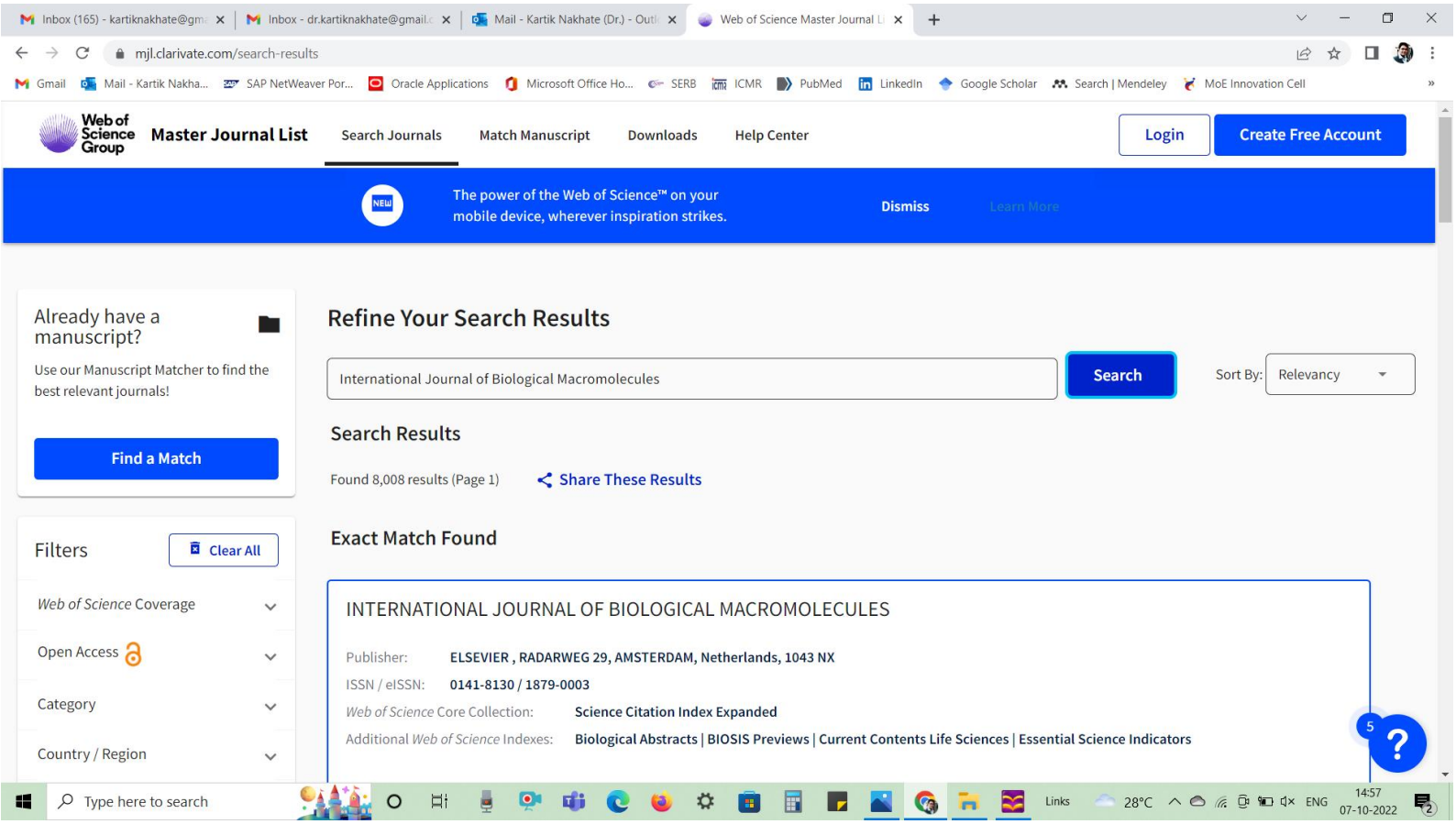
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