Environ Sci Pollut Res
DOI 10.1007/s11356-016-8024-z

RESEARCH ARTICLE

Isolation, characterization and the potential use of starch from jackfruit seed wastes as a coagulant aid for treatment of turbid water

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Received: 16 May 2016 / Accepted: 31 October 2016

Abstract Fruit wastes constituting up to half of total fruit weight represent a large pool of untapped resources for isolation of starch with diverse applications. In this work, the possibility of isolating starch from tropical fruit wastes and its extended application as a natural coagulant was elucidated. Amongst the 12 various parts of fruit wastes selected, only jackfruit seeds contained more than 50% of total starch content. Using alkaline extraction procedures, starch has been successfully isolated from local jackfruit seeds with a yield of approximately 18%. Bell-shaped starch granules were observed under SEM with a granule size ranging from 1.1 to 41.6 μm. Detailed starch characteristics were performed to provide a comparison between the isolated seed starch and also conventional starches. Among them, chemical properties such as the content of starch, amylose, amylopectin and the corresponding molecular weights are some of the key characteristics which governed their performance as natural coagulants. The potential use of isolated seed starch as an aid was then demonstrated in both suspensions of kaolin (model synthetic system) and *Chlorella* sp. microalga (real-time application) with plausible outcomes. At optimized starch dosage of 60 mg/L, the overall turbidity removal in kaolin was enhanced by at least 25% at a fixed alum dosage of 2.1 mg/L. Positive turbidity and COD removals were also observed in the treatment of *Chlorella* suspensions. Starches which served as bridging agents aided in the linkage of neighbouring microflocs and subsequently, forming macroflocs through a secondary coagulation mechanism: adsorption and bridging.

Keywords Jackfruit seeds · Starch properties · Amylopectin · Coagulant aid · Microalgae harvesting · Bridging mechanism

Responsible editor: Bingcai Pan

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Introduction

Fruits such as bananas have been widely consumed across the globe as they are loaded with nutrients among the many other health benefits. As the production capacities of fruits increased steadily by at least 14% from the past 5 years (FAOSTAT 2013), intensified generations of fruit wastes which require proper disposals becomes more worrisome. However, these wastes are often regarded as low in commercial values and would pose serious environmental threats in the absence of proper handling. Besides banana, other tropical fruits such as jackfruit, papaya and rambutan are among some of the preferred fruits consumed fresh and processed in Malaysia. These fruits are easily accessible across the South East Asian region and are the top five most cultivated fruits in Malaysia (FAOSTAT 2013). Not limited to Asia, jackfruit is also widely cultivated in Latin America and Brazil (Lim 2012). As far as economic feasibility concerns, raw materials such as fruit

Published online: 12 November 2016