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Effects of Sarawak local salts and commercial sodium chloride on biofilm formation of *Vibrio cholerae*

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ABSTRACT

Aims: Bacterial biofilms can be defined as a community of microorganisms in which cells adhere to one another on a surface and are embedded in a protective matrix of lipids, nucleic acids, proteins and polysaccharides. Biofilm produced by *Vibrio cholerae* represents a significant threat to food safety, as they can lead to the transmission of diseases. Hence, the purpose of this study is to review the effect of different types of sodium chloride on minimum biofilm eradication concentration (MBEC) and morphology of biofilm formation of *Vibrio cholerae.*
Methodology and results: In this study, *V. cholerae* biofilm was treated with four different types of sodium chloride; 'Bario' salt, 'Bakelalan' salt, commercial sodium chloride and laboratory sodium chloride. By using MBEC test, the concentration of sodium chloride needed to eradicate the biofilm of *V. cholerae* was determined. Based on the result obtained, commercial sodium chloride and laboratory sodium chloride showed the highest anti-biofilm activity against the biofilm of *V. cholerae* at 500 mg/mL concentration while no complete eradication of *V. cholerae* biofilm was achieved when treated with Sarawak local salts ('Bario' salt and 'Bakelalan' salt). However, noticeable inhibitions of bacterial growth were seen at the highest concentration of local salts.
Conclusion, significance and impact of study: Commercial sodium chloride and laboratory sodium chloride showed a better anti-biofilm activity towards the *V. cholerae* biofilm formation as compared to the local salts. Thus, commercial sodium chloride and laboratory sodium chloride can be an effective anti-biofilm agent to mitigate the biofilm formation of *V. cholerae.* Further studies can be done to determine the MBEC values of other pathogenic bacteria against commercial and laboratory sodium chloride.

Keywords: Bacterial biofilms, sodium chloride, minimum biofilm eradication concentration (MBEC), anti-biofilm, industrial process

INTRODUCTION

Recent studies have reported that more than 99% of microorganisms in this world live in form of biofilms (Prakash *et al.*, 2013). Bacterial biofilms can be defined as communities of microorganisms, which are attached on a substratum and work together to form a protective extracellular polymer in order to survive from environment stressors. The first evidence and discovery of bacterial formation was observed by Antonie van Leeuwenhoek. He discovered the bacterial biofilm adhered on his own teeth and described it as "animalcules" (Percival *et al.*, 2011). Bacteria in form of biofilm can survive in unexpected environment stressors such as antimicrobial agents, disinfection treatment, temperature changes, pH changes, ultraviolet rays to mention a few (Costerton *et al.*, 1999). These bacterial biofilms are resistant against antimicrobial agents because they can resist the phagocytic activity and host immune mechanism (Costerton *et al*., 1999). Most bacteria are capable of forming biofilms. Therefore, bacterial biofilm has become a major concern and causes a lot of problems to food industries.

Sodium chloride can be described as ionic compound added in various foods and medicines. It is also known as common salt or table salt. Sodium chloride is often used for cooking to enhance the taste of food and to improve food texture. It also has been viewed as food preservative by inhibiting the growth of microorganisms in food that spoil the food products and reduce their shelf life (Marjorie and Kathleen, 2010).

Biofilms produced by bacteria create significant threats to food safety and public health. Bacterial biofilms contribute to cross-contamination of food products and serious hygienic problems which can lead to foodborne diseases. They also can cause economic losses to food

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