Enzymatic activity profile of *Streptomyces* spp. isolated from nipah mangrove sediment in Sungai Kakap District, West Kalimantan

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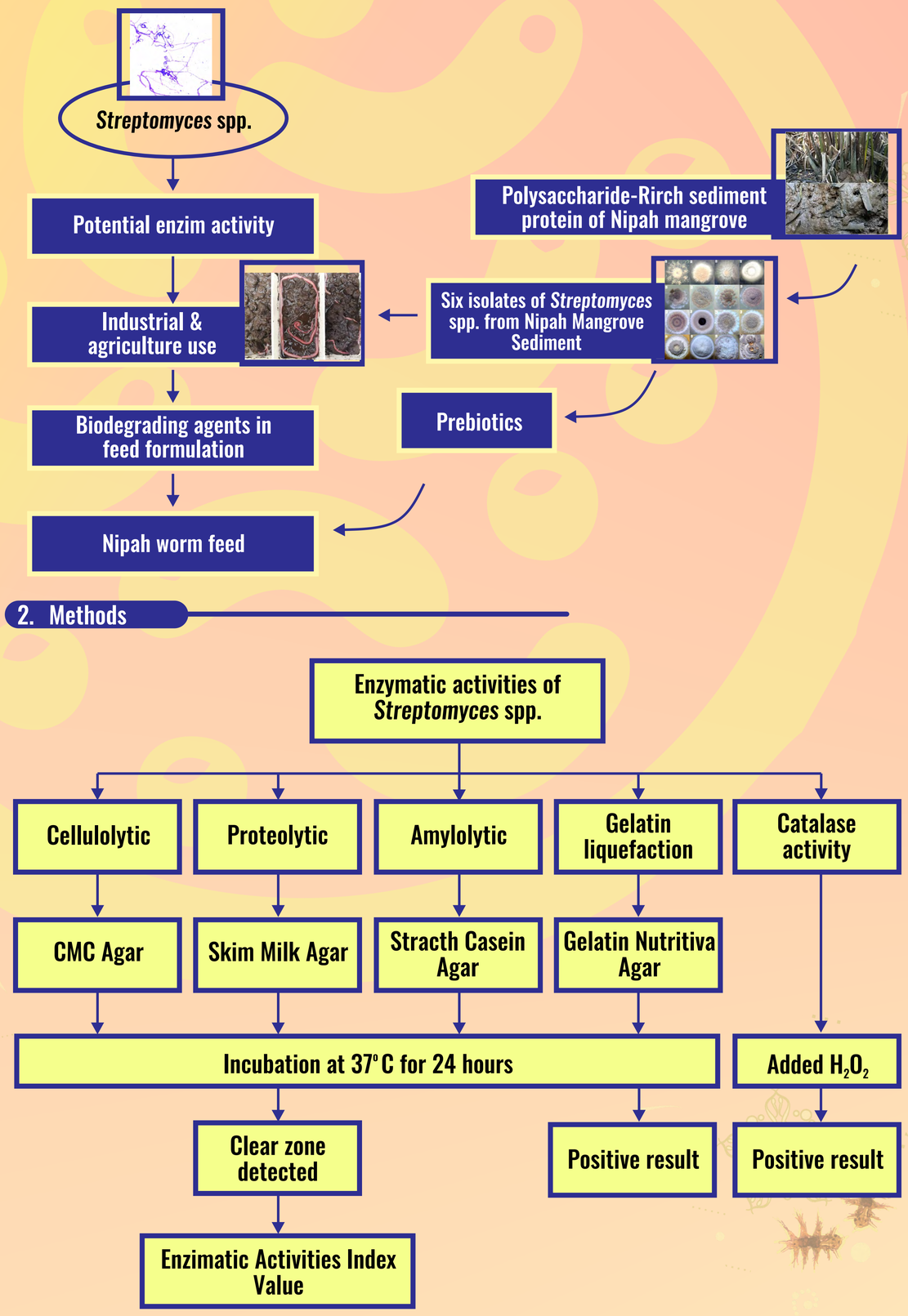
Abstract

Streptomyces plays a role in the degradation process of organic compounds that existed on the soil, especially in the mangrove area through several enzyme activities. These bacteria can help in providing organic ingredients as a food source for organisms that live around mangroves including the nipah worms (Namalycastis rhodochorde). This study aims to determine the enzyme activity profile of seven actinomycetes culture that have been isolated from mangrove soil in Sungai Kakap district, West Kalimantan. Determining of enzymatic activity was carried out on agar base which was added with starch, milk casein, cellulose and gelatine. Catalase activity was conducted using 3% of H2O2 solution. The results showed that six Streptomyes spp. had proteolytic, cellulolytic, amylolytic, gelatin liquefaction, and catalase activities. Streptomyes NrASA1 has the highest proteolytic activity index values, namely 0.57. Streptomyes NrASA3 and Streptomyes NrASA4 has the highest amylolytic and cellulolytic activity index values, respectively 0.76 and 1.15. The enzymatic activity profile of indigenous Streptomyes spp. can be utilized for the development of feed formulas for nipah worm.

Keywords : *Streptomyes, cellulolytic, proteolytic, amylolytic, nipah mangrove*

1. Introduction



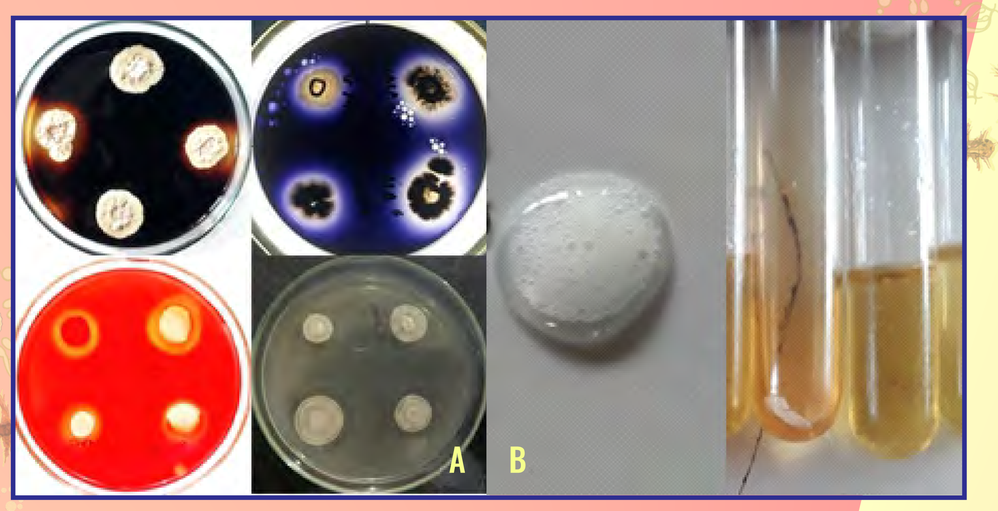


Figure 1. Visualization of the relative index values of cellulolytic (left), amylolytic, and proteolytic (right) activity of Streptomyes spp. which is isolated from nipah mangrove sediments, through clear zone parameters (A); gelatin liquefaction and catalase activity identified by simultaneous bubbles (B).

2. Methods

3. Result

The ability of bacterial isolates isolated from palm worms to break down macromolecules of carbohydrates, proteins, inorganic compounds was tested by observing the decomposition of cellulose, skim milk, starch, gelatin, and hydrogen peroxide qualitatively and quantitatively.

Codes	Enzymatic activities					
	Cellulolytic		Proteolytic		Amilolytic	
	D- CZ	C index	D-cz	P index	D-cz	A index
NrASA1	13.95	0.88	17	0.57	20.44	0.43
NrASA2	22.5	0.32	0	0	26.26	0.54
NrASA3	12.46	0.45	15	0.45	29.49	0.76
NrASA4	17.17	1.15	16.5	0.36	22.07	0.37
NrASA5	24.68	0.54	0	0	28.66	0.38
NrASA6	21.44	0.3	0	0	19.78	0.12

Table 1. Visualization of the relative index values of cellulolytic (left), amylolytic, and proteolytic (right) activity of Streptomyes spp. which is isolated from nipah mangrove sediments, through clear zone parameters (A); gelatin liquefaction and catalase activity identified by simultaneous bubbles (B).

4. Discussion

Enzymatic activities, including cellulolytic, amylolytic, proteolytic, and gelatinase activity, have been widely studied in order to explore the potential of a microorganism so that it can be utilized in industry and aquaculture. Actinomycetes are one of the most potential microorganisms to be developed because they have primary and secondary metabolites which are potential for industrial interests. Therefore, many researchers have explored the enzymatic and secondary metabolite activity of this group of bacteria.

A number of research workers in earlier investigation have also reported that actinomycetes from soil and water bodies possessed high number of enzymatic activities. Patke and Dey (1996), Chaphalkar and Dey (1993) have reported protease activity in isolated actinomycetes. Shejul (1999) have reported gelatinase activity in isolated actinomycetes. Amylase activity in actinomycetes has been reported by Abraham and Herr (1964), Fogarty (1983), Williams et al. (1983), Obi and Obido (1984), Stanford et al. (2001) and Nawani et al. (2002). Cellulase activity in actinomycetes has been reported by Konde (1978), Hagerdal et al. (1980), Moreira et al. (1981), Deobald and Crowford (1987). Streptomyes is a group of actinomycetes that have great potential as agents for degrading organic compounds. As previously studied, Streptomyes isolated from nipah mangrove sediments were known to have catalase and gelatinase activity (Tab. 2). Holt et al. (1994) stated that catalase and gelatinase activities were the main characters of the genus Streptomyes. both of these activities are major markers that Streptomyes has a wide diversity of enzymatic abilities.

Gulve and Desmukh's research (2011) stated that 80% of actinomycetes isolated from marine sediments are Streptomyes spp. The Streptomyes have been tested to have cellulolytic, proteolytic, amylolytic, and chitinolytic activity. The same thing was found in this study. Streptomyes isolated from nipah mangrove sediments in Sungai Kakap Village showed cellulolytic, amylolytic, proteolytic, and gelatinase activity (Table 1). The difference in the results of this study was the ability of cellulolytic and proteolytic. It could be seen that 100% of all strains of Streptomyes spp. in this study were able to degrade cellulose, while the Gulve and Desmukh (2011) said that only 40% of cellulolytic activity was detected from the total total strain. However, contrary to proteolytic activity, this study detected only 50% of the total number of strains, whereas Gulve and Desmukh (2011) detected 80% of the total strains.

Different types of sediments or growth substrates of Streptomyes certainly affect the enzymatic activity of bacterial cells. Streptomyes spp. (NrASA1 - NrASA6) isolated from nipah mangrove sediments had higher cellulolytic and amylolytic activity compared to proteolytic. This was caused by the sediment of nipah mangrove which is rich in organic material from litter plants. Nipah plants were known to be rich in cellulose biomass and starch (Jian et al., 2010). This is different from the condition of marine sediments that are rich in protein. However, the detection of 50% of the proteolytic ability of strains of Streptomyes NrASA1, Streptomyes NrASA3, Streptomyes NrASA4 also proves that strains derived from polysaccharide-rich substrates still have their proteolytic abilities.

5. Conclusion

The conclusion of this study is that all strains of Streptomyes spp have amylolytic, cellulolytic, gelatinase, and catalase activity. However, only three strains have proteolytic abilities, in addition to the previously mentioned abilities, namely Streptomyes NrASA1, Streptomyes NrASA3, and Streptomyes NrASA4. The enzymatic activity index shows that the three strains can be developed as a degrading agent of complex organic compounds in the production

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