

MODIFICATION OF MEDIA FORMULATION FOR ENHANCING
PRODUCTION OF EXTRACELLULAR POLYSACCHARIDES BY *Porphyridium*
cruentum

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A dissertation submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Science (Biotechnology)

Faculty of Biosciences and Medical Engineering
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JANUARY, 2013

*A special dedication to my lovely parents,
family, fiancée and friends*

ACKNOWLEDGEMENTS

I would like to take this opportunity to dedicate my endless gratitude, sincere appreciation and profound regards to my dearest supervisor, Dr. Haryati Jamaluddin for her scholastic guidance. She has been instrumental in guiding my research, giving me encouragement, guidance, critics and friendship. Without you this thesis will not be presented as it is today.

Furthermore, I would like to convey my appreciation toward Miss Katijah Mahat and Miss Dalila Mat Zaki for their guidance and support. Not forgetting the helpful lab assistant Mr. Khairul and Mr. Hafizi for all their assistances throughout my research. My sincere appreciation also extends to all my lab mates in special equipment laboratory who have provided assistance at various occasions.

Last but not least, my special gratitude to my lovely parents and family members for their support and concern, special thanks also to my love one that always had been there for me. Not to forget, my course mates and friends who had given their helps and guidance all the time with love. Their mentorship was truly appreciated.

ABSTRACT

The red microalgae *Porphyridium cruentum* produce many valuable compounds such as extracellular polysaccharides (EPS) that are extensively used in the industry. In this study modification of media formulation for optimal production of EPS from *Porphyridium cruentum* was carried out by varying nitrate, sulfate and glucose concentrations in the Jones 1962 media. Different concentration of each nutrient was used in the media formulation. For nitrate, the highest concentration provided in the medium at 50 mM showed the highest growth rate and EPS production, but by inhibiting the nitrate concentration, the growth is reduced while the production of EPS is increased as when a high concentration of nitrate was provided to the medium. For sulfate, increasing concentration in the media showed great decrease in growth rate, but increasing EPS production, the highest production of EPS was at 50 mM which was the highest concentration of sulfate provided in the media modification. Addition of glucose in the medium on the other hand substantially increased the growth rate and the biomass production but as the glucose concentration kept on increasing, it also inhibited the production of EPS by the algae. The growth rate of the algae did not correlate with the EPS production. The result showed that high concentration of glucose and low concentration of nitrate and sulfate inhibited the production of EPS by the microalgae and in order to increase the EPS production, medium without nitrate or a very high concentration of nitrate or and sulfate must be provided. Therefore, the optimum medium formulation for optimal growth and EPS production by *Porphyridium cruentum* is at either 20 mM of nitrate or without nitrate at all, 50 mM of sulfate and 0.5% (w/v) of glucose. The compositions of the EPS were also confirmed by using HPLC that showed the composition of glucose, galactose and xylose of the EPS.

ABSTRAK

Mikroalga merah *Porphyridium cruentum* menghasilkan banyak sebatian berharga seperti rembesan polisakarida luar sel (EPS) yang digunakan secara meluas di dalam pelbagai industri. Dalam penyelidikan ini, pengubahsuaian kepekatan nutrisi nitrat, sulfat dan glukosa dilakukan terhadap formulasi media Jones 1962 untuk memperoleh pengeluaran optimum EPS dari *P. cruentum*. Bagi nitrat, semakin tinggi kepekataannya, semakin tinggi kadar pertumbuhan dan penghasilan EPSnya namun dengan tidak membekalkan nitrat di dalam medium, kadar pertumbuhan mikroalga semakin berkurang tetapi penghasilan EPS meningkat seperti jika dibekalkan kepekatan nitrat yang tinggi. Pengubahsuaian kepekatan sulfat pula menunjukkan penurunan yang amat banyak dari segi kadar pertumbuhan mikroalga apabila kepekatan sulfat yang tinggi di bekalkan pada medium. Bagi penghasilan EPS, kepekatan sulfat yang tinggi (50 mM) menunjukkan penghasilan EPS yang tertinggi. Penambahan glukosa dalam medium menunjukkan peningkatan kadar pertumbuhan dan pengeluaran biojisim yang sangat tinggi namun ia menyekat penghasilan EPS dari alga dengan menunjukkan penghasilan EPS yang sangat rendah. Kadar pertumbuhan bagi *P. cruentum* tidak berkolerasi dengan pengeluaran EPSnya. Hasil kajian menunjukkan bahawa kepekatan glukosa yang tinggi dan kepekatan nitrat dan sulfat yang rendah menghalang pengeluaran EPS oleh *P. cruentum*. Justeru, untuk meningkatkan pengeluaran EPS, bagi kepekatan nitrat, medium boleh disediakan dengan tidak meletakkan nitrat ataupun dengan meletakkan kepekatan nitrat dan sulfat yang sangat tinggi. Formulasi medium yang optimum bagi pertumbuhan dan penghasilan EPS optima oleh *Porphyridium cruentum* ialah diantara tanpa kandungan nitrat ataupun pada 20 mM nitrat, 50 mM sulfat dan 0.5% (w/v) glukosa. Komposisi EPS juga dikenalpasti mengandungi glukosa, galaktosa dan xylosa melalui HPLC.