DEVELOPMENT OF NANOFILTRATION MEMBRANE FOR FRESHWATER AQUACULTURE WASTEWATER TREATMENT

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MASTER OF SCIENCE
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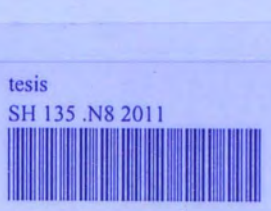

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Aquaculture produces considerable quantities of organic matter, ammonia, and phosphorus during cultivation processes. These wastes must be discarded from the fish pond and treated before discharging into water bodies to prevent toxicity to the aquatic life and worsen the water quality. Aquaculture waste which is left without properly treated will cause deterioration to the water quality inside the pond or receiving water. Several attempts had been adopted to remove the effluent of dissolved nitrogen and phosphorus compounds in the water including biological treatment, biofilter and trickling filter, but yet still cannot meet the water quality standard. As a result, membrane technology had been chosen as the tertiary treatment of aquaculture wastewater focusing on the removal of ammonia and phosphorus. These two pollutants were selected since they were the major contributing problem after the secondary treatment. The aim of this study is to develop the most appropriate membrane in order to remove ammonia and

phosphorus from the aquaculture wastewater. The influence of polymer concentration and post treatment medium were investigated in terms of permeability coefficient, charged solute separation, molecular weight cut off, membrane morphology and fine structural details. The effect of pH on the membrane surface charge was also examined due to the fact that pH has a great influence to the the surface charge. The PSF 21% in ethanol post treatment medium (NF21-E) has the optimum performance for aquaculture wastewater treatment. The results indicated that NF21-E produced a relatively high quality of permeate which can remove up to 66% ammonia, 85% total ammonical nitrogen (TAN) and 95% phosphorus with high flux permeability of 0.499 to 0.712 $L/m^2.h$. This promising result was observed at pH 6 with applied pressure of 6 bars. It is proven that by altering the water pH, the changing of the membrane surface charge could be observed. This finding demonstrated that polymer concentration and post treatment medium have a tremendous significant effect to the membrane selectivity and productivity. Furthermore, membrane surface charge plays an important role in the enhancement of membrane performance. This study indicated that membrane technology offer an alternative treatment for aquaculture wastewater and helps to elevate aquaculture production quality.

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PEMBANGUNAN MEMBRAN PENURAS NANO DALAM MERAWAT AIR SISA AKUAKULTUR AIR TAWAR

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Semasa proses pemeliharaan hidupan akuakultur, bahan-bahan organic, amonia dan fosforus banyak terhasil. Bahan-bahan sisa perlu di singkirkan dan dirawat sebelum dibebaskan ke sungai supaya dapat mengelakkan daripada membahayakan hidupan akautik yang lain dan mencemarkan kualiti air. Sisa akuakultur yang dilepaskan ke kolam atau sungai tanpa rawatan akan menyebabkan pencemaran air. Walaupun pelbagai usaha dilakukan untuk merawat nitrogen terlarut dan fosforus seperti rawatan biologi, penuras bio, dan penuras cucur, namun masih tidak dapat menghasilkan kualiti air yang baik. Oleh itu, teknologi membran dipilih sebagai rawatan peringkat ketiga untuk rawatan air sisa akuakultur yang mana fokus utama adalah untuk merawat ammonia dan fosforus. Kedua-dua bahan tersebut masih menjadi bahan pencemar utama dalam air sisa akuakultur. Kajian ini bertujuan untuk menghasilkan membran penuras nano yang paling sesuai untuk merawat ammonia dan fosforus dalam air sisa

akuakultur. Kesan kepekatan kandungan polimer dan media pasca rawatan ke atas membran penuras dikaji dari segi pekali kebolehtelapan, pemisahan bahan bercas, saiz molekul, morfologi membran dan pencirian struktur khusus membran. Kesan pH terhadap cas permukaan membran juga dikaji memandangkan kesannya adalah sangat besar ke atas perubahan cas permukaan. Membran dengan 21% kepekatan polimer yang direndam dalam etanol (NF21-E) adalah membran yang sesuai untuk merawat air sisa akuakultur. Hasil kajian menunjukkan NF21-E mempunyai kualiti air tapisan yang relatifnya tinggi dimana ia boleh menyingkirkan 66% ammonia, 85% ammonikal nitrogen total (TAN), 95% fosforus. NF21-E juga mempunyai kadar fluks yang tinggi (0.499 hingga 0.712 $L/m^2.h$). Keputusan yang diperolehi itu adalah pada pH 6 dan tekanan 6 bar. Ini menunjukkan, dengan pengubahsuaian pH, cas permukaan membran turut berubah, di mana ia menyumbang kepada peningkatan prestasi membran. Hasil kajian membuktikan kandungan kepekatan polimer dan media pasca rawatan sangat mempengaruhi keupayaan pemisahan dan kebolehtelapan membran. Cas permukaan membran juga memainkan peranan penting dalam meningkatkan prestasi penapisan membran. Oleh itu, membran adalah satu rawatan alternatif yang boleh digunakan untuk merawat air sisa akuakultur dan dapat meningkatkan kualiti pengeluarannya.