# THE ROLE OF MEMBRANE SURFACE CHARGE ON PROPERTIES AND THE PERFORMANCES OF POLYMERIC MEMBRANES FOR PROTEIN APPLICATION

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# THE ROLE OF MEMBRANE SURFACE CHARGE ON THE PROPERTIES AND THE PERFORMANCES OF POLYMERIC MEMBRANES FOR PROTEIN APPLICATION

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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:
THE ROLE OF MEMBRANE SURFACE CHARGE ON THE PROPERTIES AND PERFORMANCES OF POLYMERIC MEBRANES FOR PROTEIN APPLICATION oleh PANIMALAR A/P BASKARAN No.Matrik UK7714 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Kejuruteraan sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah SARJANA MUDA TEKNOLOGI (ALAM SEKITAR), Fakulti Sains dan Teknologi , Universiti Malaysia Terengganu.

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## LIST OF SYMBOL/ABBREVIATIONS

**Symbol/Abbreviation**

| | | |
|---|---|---|
| PSF | - | Polysulfone |
| NMP | - | N-Methyl-2-Pyrrolidone |
| $H_2O$ | - | Water |
| UF | - | Ultrafiltration |
| MF | - | Microfiltration |
| MWCO | - | molecular weight cut off |
| BSA | - | Bovine Serum Albumin |
| EKA | - | Electro Kinetic Analyzer |
| RTU | - | Remote Titration Unit |
| Da | - | Dalton |
| mV | - | milivolt |
| NaCl | - | Sodium Chloride |
| $P_m$ | - | Permeability |
| $C_p$ | - | concentration of permeate |
| $C_f$ | - | concentration of feed |
| $C_r$ | - | concentration of retentate solution |
| $C_b$ | - | bulk concentration |

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## ABSTRACT

Ultrafiltration has become an alternative technology for protein separation over conventional bioseparation processes because of its high throughput of product. Although ultrafiltration is a useful method for protein separation,it is prone to biofouling. Fouling can be reduced by using membranes with suitable charge to the solute being filtered and this could also allow selective separation. A study to investigate the role of membrane surface charge and the influence of different polymer concentration on ultrafiltration membrane performance for protein separation has been performed. Asymmetric ultrafiltration membranes were produced using ternary composition consist of polysulfone, N-methyl-2-pyrrolidone and water by a dry/wet phase inversion using an electrically controlled flat sheet membrane casting machine. Based on BSA ultrafiltration experiment, rejection ranging from 94.3% to 100% was obtained for membranes fabricated with polymer concentrations of 11wt%, 13wt%, 15wt% and 17wt%. The optimum polymer concentration for protein separation is 17wt% which gave 100% rejection. A negative Zeta Potential (ZP) was obtained for all the membranes that consist of different polymer concentration. The most optimum ZP value for 100% BSA protein removal was -12.3mV, obtained for 17wt% membrane. This study has proposed that membrane with a higher negative charge is a suitable membrane for BSA protein separation. This research has indicated that polymer concentration and membrane surface charge affects the membrane performance and structural properties, consecutively enhancing the membranes ability for BSA separation.