

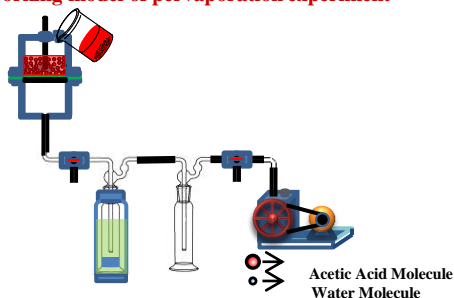
Poster presentation

Effect of Dibutylphthalate on Sodium Alginate Membranes on Stability and Pervaporation Performance of Acetic acid-water Mixtures.

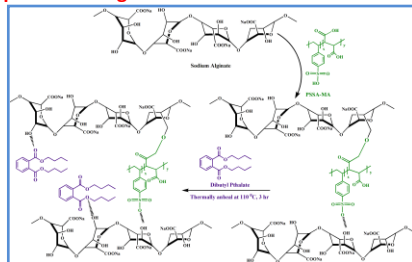
Dr. Padmeshwary R, Assistant Professor, Department of Chemistry, KLE'S P. C. Jabin Science College, Hubballi-32, India

ABSTRACT: Plasticized sodium alginate membranes were developed by incorporating DBT (Dibutyl Phthalate) in the PSSAMA crosslinked sodium membrane matrix as a pervaporation membrane by employing a solution technique. The Plasticized membranes were characterised by FTIR, WAXD, DSC, TGA, SEM and UTM technique. Membranes were tested for their ability to separate Acetic acid/water at azeotropic point. The experiment results demonstrated that the membrane containing 6 wt% of Dibutyl Phthalate showed highest separation selectivity of 36102 with a flux of 12.57×10^{-2} kg /m² h for the azeotropic mixture of at 30 °C. The membranes were further tested for Pervaporation at 40, 50 and 60 °C for water containing feeds of aqueous acetic acid solution to confirm their stability at higher temperature. The total flux and the flux of water were found to be overlapping each other for all plastised membranes, suggesting that these membranes could be used effectively to break the azeotropic point. From the temperature dependency of diffusion and permeation values, the Arrhenius activation parameters were estimated and discussed in terms of membrane efficiency. The activation energy values obtained for water permeation (E_{pw}) were significantly lower than those of acetic acid permeation (E_{pAA}), suggesting that the developed membranes have higher separation efficiency for water-Acetic acid system. The negative heat of sorption (ΔH_s) values was obtained for all the membranes, indicating that Langmuir's mode of sorption is predominant in the process.

Working model of pervaporation experiment



Scheme for the development of DBP incorporated plasticized alginate membranes.



Mechanical properties of Plasticized NaAlg/PSSAMA membranes

| Membranes | Tensile strength (MPa) (+5.0%) | Young's modulus (MPa) | Elongation at break (%) ($\pm 6.0\%$) |
|-----------|--------------------------------|-----------------------|---|
| DBP-0 | 125.90 | 10489.0 | 127.65 |
| DBP-1 | 81.59 | 7430.2 | 140.55 |
| DBP-2 | 71.60 | 2856.8 | 194.13 |
| DBP-3 | 70.69 | 3413.8 | 222.77 |
| DBP-4 | 70.06 | 6366.1 | 96.78 |

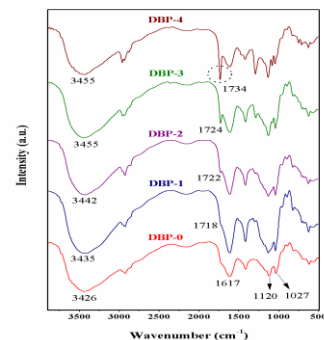
Temperature effect

| T °C | $J \times 10^2$ (kg/m ² h) | | | | | α_{sep} | | | | |
|---------|---------------------------------------|-------|-------|-------|-------|----------------|-------|-------|-------|-------|
| | DBP-0 | DBP-1 | DBP-2 | DBP-3 | DBP-4 | DBP-0 | DBP-1 | DBP-2 | DBP-3 | DBP-4 |
| 30 | 13.61 | 12.38 | 16.41 | 17.46 | 18.03 | 6419 | 7490 | 11240 | 22489 | 29990 |
| 40 | 14.96 | 14.96 | 18.11 | 19.35 | 21.10 | 2452 | 4551 | 7714 | 9491 | 14240 |
| 50 | 18.78 | 173.2 | 20.70 | 21.86 | 24.79 | 1094 | 4352 | 6815 | 8390 | 9291 |

Arrhenius Parameters for Permeation, Diffusion and Heat of Sorption

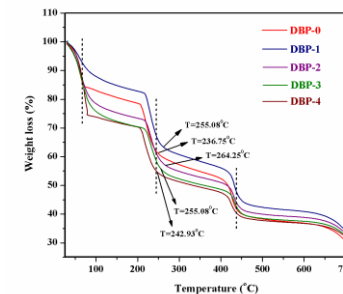
| kJ/mol | DBP-0 | DBP-1 | DBP-2 | DBP-3 | DBP-4 |
|------------|-------|-------|-------|-------|-------|
| E_p | 9.42 | 9.13 | 12.95 | 13.06 | 13.69 |
| E_D | 10.07 | 9.76 | 13.67 | 13.82 | 14.70 |
| E_{pw} | 9.39 | 9.10 | 12.92 | 13.00 | 13.63 |
| E_{Dw} | 10.02 | 9.76 | 13.93 | 13.76 | 14.35 |
| E_{DIPA} | 37.77 | 38.79 | 40.65 | 42.93 | 45.47 |

FTIR Spectroscopy

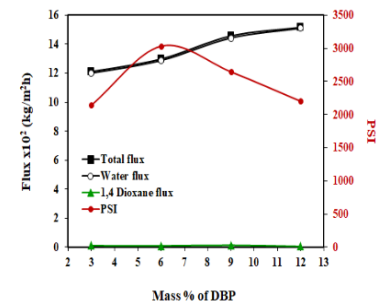


New bands appeared at around at 1718 cm^{-1} (C=O stretching mode) in the DBT incorporated Na-Alg/PSSAMA membranes.

TGA Studies



Total flux, fluxes of water and AA vs DBT Wt % of PSSA-MA



Total flux & water flux plots are overlapping

CONCLUSIONS

- The DBT acted as a plasticizer and enhancer of the hydrophilic property of the membrane.
- Total flux and flux of water were overlapping each other in membranes having DBT.
- The E_p and E_D values for Water-Acetic Acid mixtures ranged between 9.42 to 13.69 and 10.07 to 14.70 kJ/mol.