**ABSTRACT**

Among the various organs present in a human body, kidney is such an organ which, once damaged, can never be brought back to its original state. Once the extent of renal damage exceeds a certain degree, then either kidney transplant or undergoing hemodialysis are only options for the patient to survive. Hemodialysis is carried out with help of hemodialyzers with specialized, clinical grade fibers. India does not possess the technology to manufacture these clinical grade fibers. In fact, only a handful of companies around the world are capable of manufacturing (or spinning) these fibers. Hence, all hemodialyzers in India are imported costing Rs. 1500-2000. This makes the whole dialysis treatment a very expensive process, since a patient ideally requires 3-4 such cartridges per week.

This thesis addresses this problem by designing a complete process to make spinning of such clinical grade fibers possible at a low cost. The thesis begins with synthesis of suitable material with desired biological response and physical properties, suitable for hemodialysis application. Comprehensive cytocompatibility and hemocompatibility analysis were carried to test the suitability of the material. Once the correct composition was established, a low cost, less energy intensive process was designed to spin affordable hemodialysis grade hollow fiber membranes. These membranes cater to the international clinical specification of 220 microns inner diameter and 35 microns thickness. Once the process was optimized, various grades of hemodialysis fibers were spun from high efficiency to high performance. The membranes were characterized in detail and their performances were evaluated in vitro and clinical parameters were evaluated in diffusive mode. The next effort was to devise and optimize a proper post processing technology for these fibers in order to yield the desired surface properties. The fibers were compared with the standard commercial fibers and found that post processing made the fibers competitive with respect to the commercial ones. Lastly, a financial and business model was devised working with the industrial partners and teaming with appropriate stakeholders. This exercise helped in concluding that the indigenous product could be made available to the end user at Rs. 300 instead of Rs. 1500-2000.

**Keywords :** Cytocompatibility; Hemocompatibility, Hollow fiber membranes; Hemodialysis; Hemodialyzer; Fiber spinning.