

**PREPARATION AND CHARACTERIZATION  
OF POLYVINYL ALCOHOL HYDROGELS  
MODIFIED WITH HEXAMINE  
AND ANHYDROUS CALCIUM CHLORIDE**

**Ph .D. DISSERTATION**

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## ABSTRACT

Modified PVA hydrogels incorporated with hexamine and calcium chloride have been prepared and characterized. Solutions were made at the specific autoclaving condition, 0.1 MPa pressure, 121 °C temperature and 20 minutes time-frame. Films were achieved by freezing-thawing process carried out at 0 °C for more than 12 hours.

Firstly PVA hydrogel films were prepared by using different concentrations (w/w) % of PVA. Based on the mechanical properties such as tensile strength, elongation at break (%), tear strength as well as FTIR and TG-DTA analysis, it was observed that 20 (wt %) PVA hydrogel indicates an appropriate defined ratio to prepare the modified PVA hydrogel. Thus, based on the (20 wt%) PVA, modified PVA hydrogel series were prepared by using an organic additive and an inorganic additive. In these preparations, contents of additive were varied. The corresponding modified PVA hydrogel films were subjected to the determination of mechanical properties. Based on resulting mechanical properties, percent range of 2.5 - 5 % hexamine and percent range of 1.5 - 2 % CaCl<sub>2</sub> were observed to be well-defined and appropriate range of concentrations in the preparation of modified PVA hydrogel films.

Comparative characterizations were studied between 20 (wt %) PVA and modified PVA hydrogels. At these respective concentrations, the mechanical properties of modified film pertaining to tensile strength and tear strength decrease with increase in elongation at break. This trend in the mechanical properties was in contrast to the 20 (wt %) PVA hydrogel film itself.

Physicochemical properties relevant to 20 (wt%) PVA and modified hydrogels such as pH, specific gravity, refractive index and viscosity were determined. Characterizations of representing modified films were also done including FTIR, TG-DTA analysis. TG-DTA analysis indicates the thermal stability of the PVA and modified PVA hydrogel films.

The water holding capacity which is related to degree of swelling is one of the significant indexes of modified hydrogels. In the nature of a bioadhesive materials, a common review is that the greater the water holding capacity, the higher the degree of swelling. It indicates to show the suitability of the hydrogel film to be used as drug delivery system or similarly as a bioadhesive material. This view is in accord with the general view, where the modified hydrogel films were able to indicate to possess high water holding capacity in the range of 38-44 %.

The modified PVA hydrogel, particularly the hexamine incorporated hydrogel was found even to be used as an effective bioadhesive materials. This view is augmentative where the antibacterial nature of the incorporated with hexamine was tested. The modified hydrogel response to antibacterial activity of hexamine may be an indication that the modified hydrogel may be used as a drug delivery active bioadhesive material.

Based on the mechanical properties as well as on the water holding capacity together with the significant properties highlighted by TG-DTA and agar well diffusion test, it can be ascertained that the modified PVA hydrogel (20 wt % PVA – 5% Hexamine), (20 wt % PVA - 5% Hexamine - 2 % CaCl<sub>2</sub>) were found to indicate well defined performance property parameters with regard to durability, tactiness, drug delivering property, water holding capacity and degree of swelling.