# PREFACE

Textiles have a significant role in helping women overcome a variety of challenges. One essential category of medical textiles called absorbent hygiene helps to preserve women's health and cleanliness, particularly throughout their menstrual cycle, when many issues arise for them. Menstruation is the periodical discharge of blood and other reproductive materials by women, occurring about every 28 to 35 days from puberty until menopause. The uterine discharge can be absorbed by various absorbent materials such as disposable sanitary pads. Sanitary napkins are commonly used in personal care settings as a type of personal care product. Sanitary napkins serve the purpose of absorbing and retaining menstrual fluid, while also keeping it separate from the body. The research on enhancing the environmental friendliness of this disposable hygienic product has been prompted by the growing consumer awareness and the high expectations for eco-friendly options in order to preserve a healthy environment. Over the past two decades, major developments have been made in the field of science. However, it has also caused major harm to our planet's natural resources, providing seas, rivers, lakes, and soil unusable for people. Most of the waste found in landfills consists of single-use plastics such as straws, plastic cups, sanitary napkins, plastic plates, and other similar items. Annually, approximately 32% of the 78 million tonnes of plastic packaging produced find their way into our oceans. This number is projected to increase twice by 2030 and triple by 2050. By 2050, it is predicted that the amount of plastic in the oceans will surpass the number of fish.

Sanitary napkins, along with baby diapers and adult diapers, are major contributors to plastic pollution in landfills due to their high plastic content of 70%. Aside from the environmental dangers, these products also pose substantial health risks to women. These chemicals can lead to bacterial vaginosis and disrupt hormonal balance, potentially causing various issues. This study solved the main issue by replacing the three layers of the sanitary napkin with environmentally-friendly alternatives made of cellulose composite polymer materials. The new materials are biodegradable and offer similar properties to the original layers, including a perforated and hydrophobic top layer, a super-absorbent middle layer, and a hydrophobic back sheet. Sanitary napkin is made up of different components comprising of various textiles and other functional materials. The functional characteristics of the components are: (i) Fluid acquisition layer: a material that is designed to quickly and efficiently absorb liquid; (ii) Distribution component: a part that evenly distributes the absorbed liquid throughout the product; (iii) Absorbent structure: a structure that is capable of absorbing and retaining liquid;

(iv) Liquid impervious membrane: a barrier that prevents liquid from passing through to protect the garments. The various materials that are utilised to make various components of sanitary napkins are nonwoven textiles, wood pulp, plastic film, paper sheet, SAP powder etc. The layers of the napkin are designated as Top sheet, Acquisition Distribution Layer (ADL), Absorbent layer and Back sheet.

The main objectives of this study are to design and develop economic and environmental healthcare products for women, specifically sanitary napkins. To meet the main objectives, the followings are the secondary objectives explored in this study.

i) To have an insight into the history of healthcare products.
ii) To explore the scope of women's hygiene.
iii) To discuss the significance of sanitary napkins.
iv) To design and develop biodegradable sanitary napkins.
v) To percept the specifics of fibers and fabrics presently considered and their practical process of applications involved in designing healthcare textiles.
vi) To determine the performance of designed sanitary napkins from the satisfaction level.
vii) To design biodegradable sanitary napkins from Silk, Organic cotton, and Corn PLA and validate their performance by testing procedures.

The thesis entitled "Development of Eco Friendly Sanitary Products" comprises six chapters. The study, aims to develop 10 different types of sanitary napkins in each variety of large and extra-large sizes. These napkin samples have been designated in to three main categories depending on the type of constituent materials used for its construction viz. Maxi, Ultra-thin and Skiny-thin. In each of these categories two different sizes of sanitary napkins have been made: Large and Extra-large designated as $SN_L$ and $SN_{XL}$. Conducted tests on sanitary napkins including absorbent and rewet tests, peel strength, seal strength, adhesive residue test, and pH test. Additionally, discussed the cost of product preparation in the results and discussion.

The results conclude that the uniform distribution of blood along the length of pad is observed among in all the sanitary napkins. All the produced sanitary napkins have not shown any leakage of the fluid. The absorption time character has shown the inverse relationship with the rewet property of the sanitary napkin. The skiny-thin biodegradable sanitary napkins shown the lowest fluid absorption time, while ultra-thin sanitary napkins have shown the highest fluid absorption time. All the sanitary napkins complied with the specified range of peel adhesion

strength and seal strength. The adhesive residue or degree of stability of sanitary napkin for all large and extra-large sizes is within the standard time limit of three seconds. The adhesive residue property that has been achieved is safe for the user. The separation of the napkin from the undergarment after use has not resulted in any distortion or damage. All large and extra-large size napkins have pH values that fall within the standard range i.e. 5.5 to 8. The pH value obtained is considered safe for the user. There will be no discomfort or irritation experienced. The napkins developed through research have significantly lower rates compared to commercially available sanitary napkins. The cost of biodegradable napkins is not significantly increasing despite of their eco-friendly characteristic.