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**DEVELOPMENT AND EVALUATION OF POLYSACCHARIDE BASED
SUPER ABSORBENT POLYMERS (SAPs) BY IRRADIATION FOR
APPLICATIONS OF AGRICULTURE**

By

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**A Thesis is Submitted in Fulfillment of the Requirement for the
Degree of Doctor of Philosophy**

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2017

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ABSTRACT

Super Absorbent Polymers (SAPs) are structurally cross-linked, highly swollen and hydrophilic polymer networks capable of absorbing a large amount of water or aqueous saline solutions, practically 10 to 1000 times of their original weight or volume. The slow release of water to the growth media could allow retention of moisture, reducing irrigation frequency hence help save farmers money spent on water. One method of manufacture of biodegradable SAPs is grafting copolymerization of suitable vinyl monomer(s) on polysaccharide in the presence of a cross-linker. Chitin, cellulose, starch, and natural gums (such as xanthan, guar and alginates) are some of the most important polysaccharides. A SAP by the name of "GAM-sorb" using cassava starch and acrylic acid graft under gamma irradiation has been produced in Vietnam. However, in Sri Lanka use of cassava starch as the main input material for producing SAP would not be practicable due to its high cost. The present study focused on evaluating the performance of the imported SAP, named GAM-sorb, on the feasibility of using it in Sri Lanka. Further, the study involved development of cross-linked Cellulose and acrylic acid grafted (cross-linked Cellulose-g-PAA(Na)) SAPs in Sri Lanka under irradiation for various practices in agriculture and the developed SAPs were named as SLSAPs. Preliminary development of SLSAP was done by using combination of conventional and microwave heating. Afterward, six cross-linked Cellulose-g-PAA(Na) SLSAPs were prepared by graft polymerization of neutralized Acrylic Acid (AA) on to three cellulose samples separately, which were extracted from bagasse using alkaline, alkaline hydrogen peroxide and microwave assisted alkaline pretreatments in the presence of N.N-methylene bisacrylamide (MBA) as a cross-linker using microwave irradiation and

gamma irradiation. Additionally, cross-linked PAA(Na) SAP was prepared without applying cellulose to compare the characteristics with developed cross-linked Cellulose-g-PAA(Na) SLSAPs under microwave and gamma irradiation. Characteristics of grafting, morphological and soil degradation of developed SAPs were identified by using Fourier Transform Infra-Red Spectrometry, Scanning Electronic Microscopy and soil burial method, respectively. Additionally, Thermo gravimetric analysis was done to identify thermal stability of developed SAPs and water absorbency were measured in distilled water and other prepared fertilizer solutions. Water release pattern in incorporated soil and room environment were evaluated. Different agricultural practices such as characteristics of seed germination in swollen SLSAPs added media, survival of transplanted seedlings in SLSAP incorporated coir dust medium, development of SLSAP added coir dust pellet for survival of seedlings, cultivation of crops in SLSAPs incorporated prepared layer wise medium and survival of cut *Chrysanthemum instagram* flowers in SLSAPs added media were evaluated. The results of experiments indicate that use of "GAM-sorb" in growth media certainly reduces the frequency of watering. Further, the developed SLSAPs had swelling ratios of 236-325 in distilled water. Compared to cross-linked PAA(Na), cross-linked Cellulose-g-PAA(Na) SAPs had highly porous structure, favourable degradability in sandy loam soil and thermal stability between approximately 200°C- 275°C. The results also indicate that developed cross-linked Cellulose-g-PAA(Na) SLSAPs are useful for seed germination, survival of transplanted seedlings, survival of cut flowers and for cultivation of crops under limited supply of water.