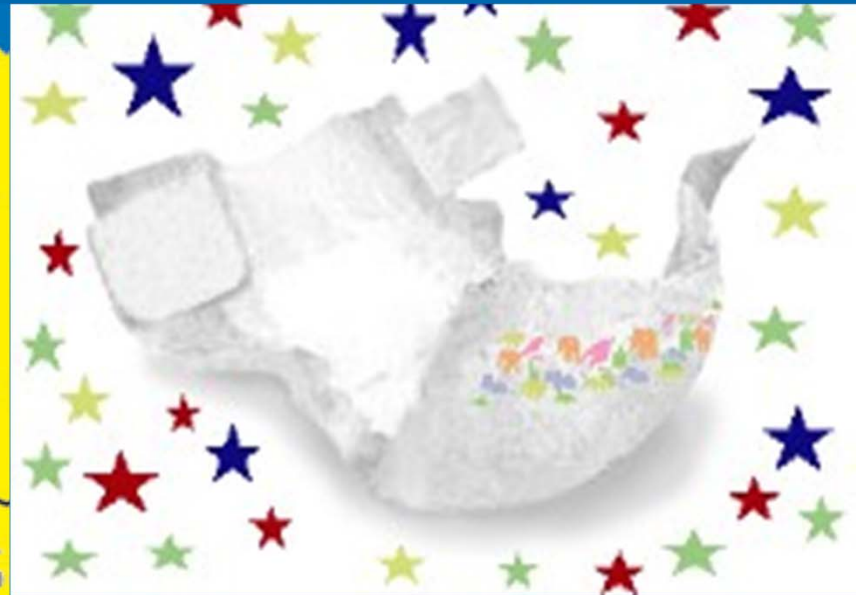
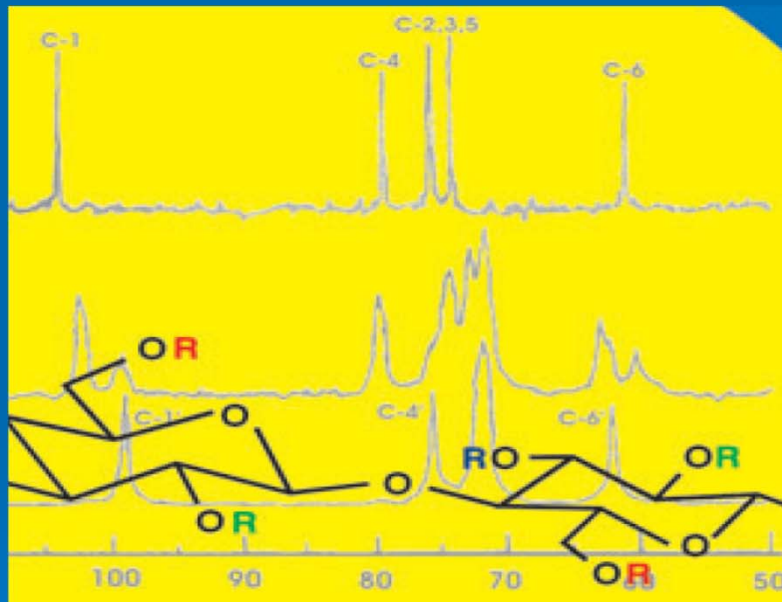


# Improved Superabsorbers Based on Sulfonated Pulps



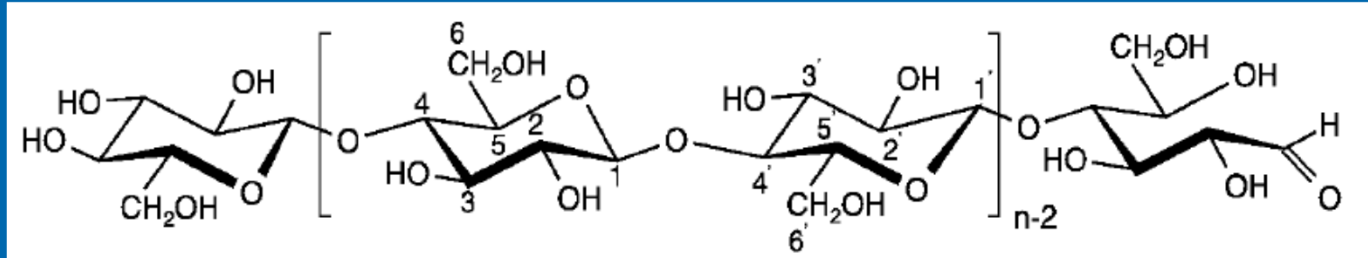
# PROJECT OBJECTIVE

- The objective of the proposed work is to provide a new technology to enhance the water absorption properties of fully bleached softwood and hardwood Kraft pulps by 20 – 50%
- This goal will be accomplished by sulfonating the carbonyl groups that are present in bleached Kraft pulps
- The results of this study will be a novel treatment for improving the water absorbency properties of tissue, towel and fluff pulp
- This project will provide a viable alternative to petroleum derived superabsorbers may used in modern products

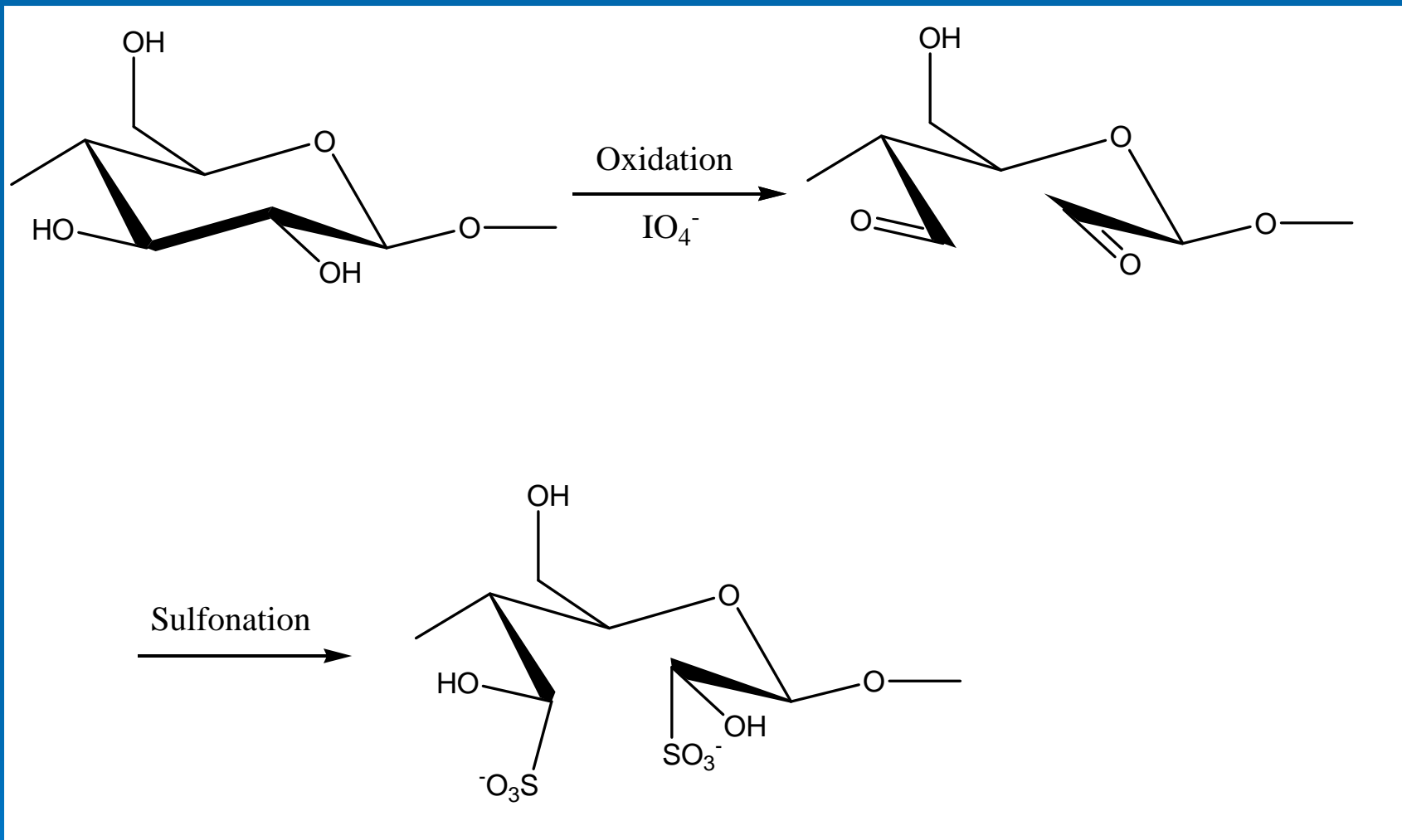
# Superabsorbers

- Superabsorbers are polymers, effectively absorb water, hydrophilic cross-linked, cannot dissolve because of their three-dimensional polymeric network structure
- In the past 50 years, research in the field of superabsorbents developed rapidly because of increasing demand
- Most superabsorbents are non-biodegradable polymer-based products, the renewed public attention favoring environmentally benign products has encouraged the development of biodegradable superabsorbers based on cellulosic material

# Functionalized Cellulose

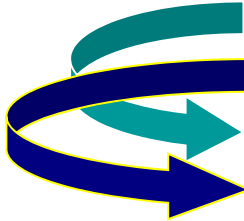
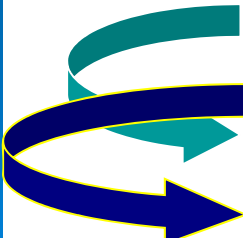


- Oxidized cellulose, without chain cleaved, characterization and derivatization
- Sulfonate oxidized cellulose, as disposable absorbent products



## Current Cellulose Modifications

# FQA measurement of cellulosic samples

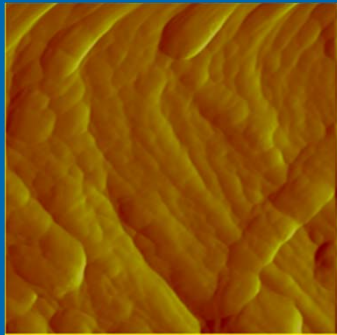
ENTRY	Arithmetic FQA Length (mm)
HW Original	0.809
 Oxidation Low	0.794
Oxidation High	0.741
Sulfonation Low	0.771
Sulfonation High	0.683
Birch Original	0.705
 Oxidation Low	0.675
Oxidation High	0.649
Sulfonation Low	0.658
Sulfonation High	0.632

## Copper Number & Total Sufonation Group of Various Samples

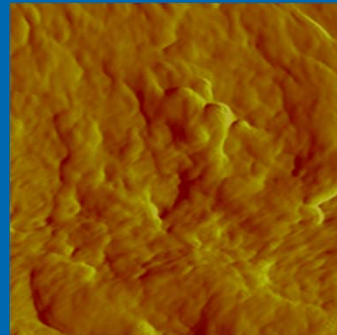
Entry	Total acid group (mmol/100 g o.d. fibers)
Cellulose Cu # = 0.68	2.00
Oxidation 1: Cu # = 5.11	1.87
Sulfonation of Oxidation 1	3.55
Oxidation 2: Cu # = 7.13	1.79
Sulfonation of Oxidation 2	5.90
ECF Bleached Birch Cu # = 0.46	6.56
Oxidation 1: Cu # = 4.29	5.08
Sulfonation of Oxidation 1	6.94
Oxidation 2: Cu # = 5.98	3.50
Sulfonation of Oxidation 2	7.21

# AFM of Native and Modified Cellulosics

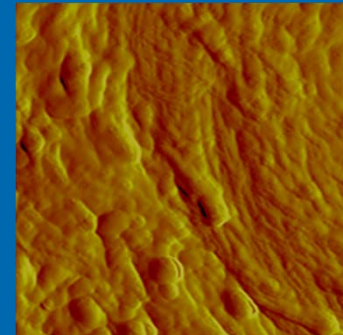
Original



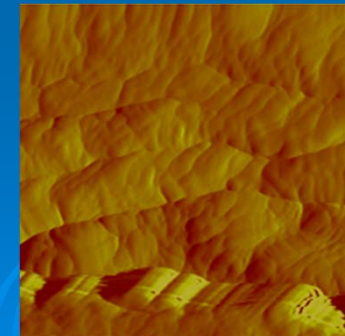
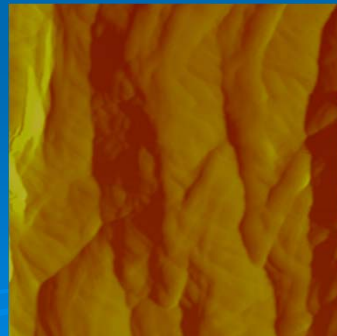
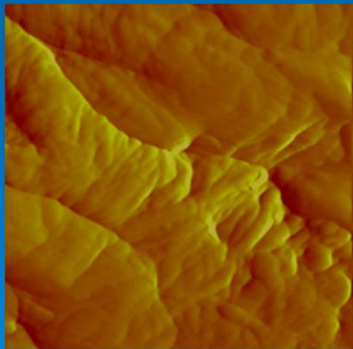
Oxidized



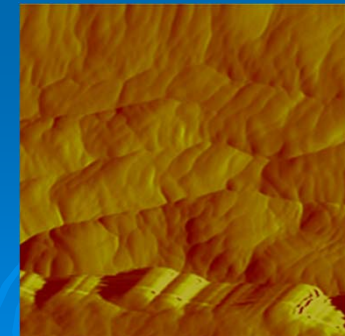
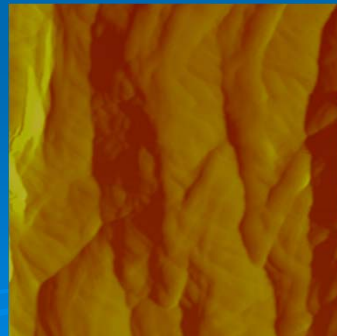
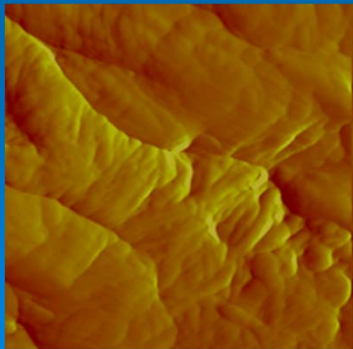
Sulfonated



Bleached HW Pulp



Bleached Birch Kraft



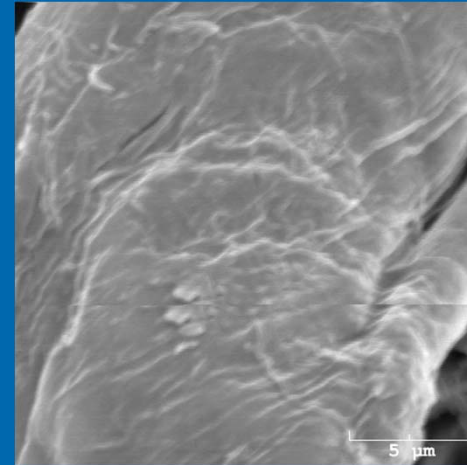
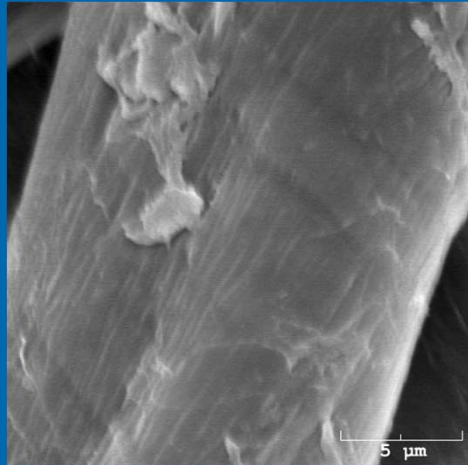


# SEM Images of Native and Modified Cellulosics

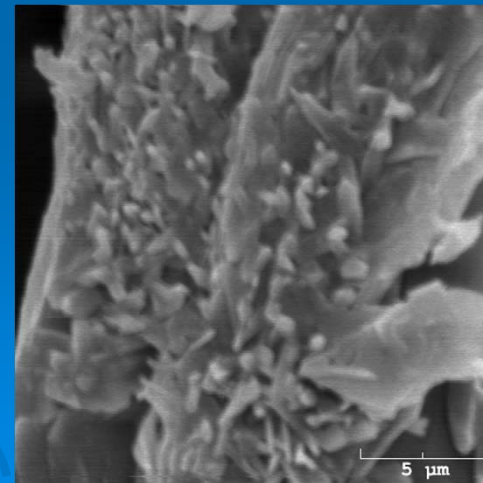
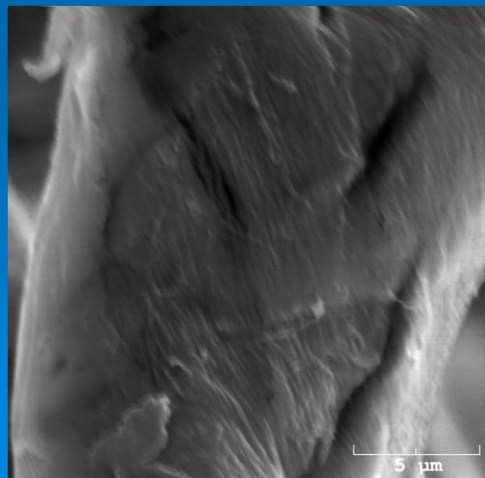
Oxidized

Sulfonated

Low



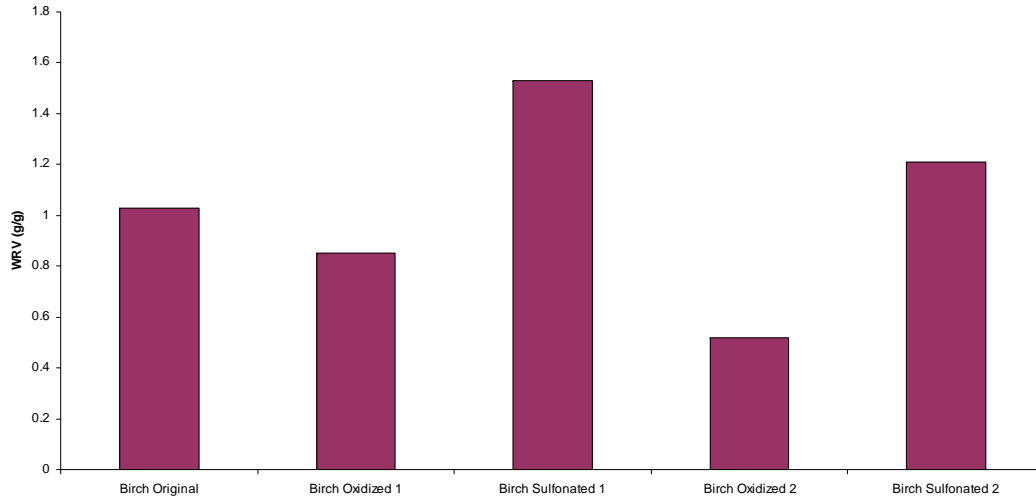
High



Bleached HW Pulp

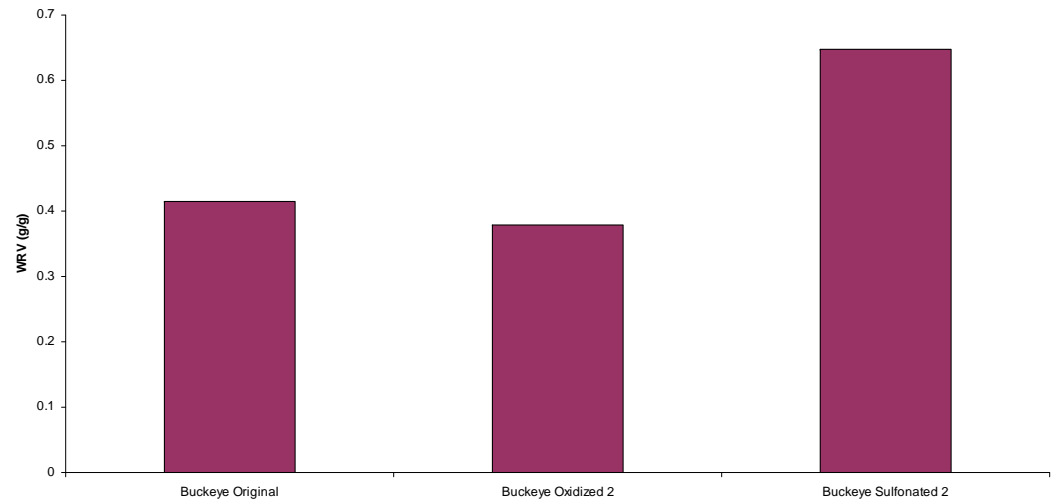
# WRVs`

ECF Bleached Birch Kraft Pulp



*Sulfonation of Cu #  
Provides higher WRV*

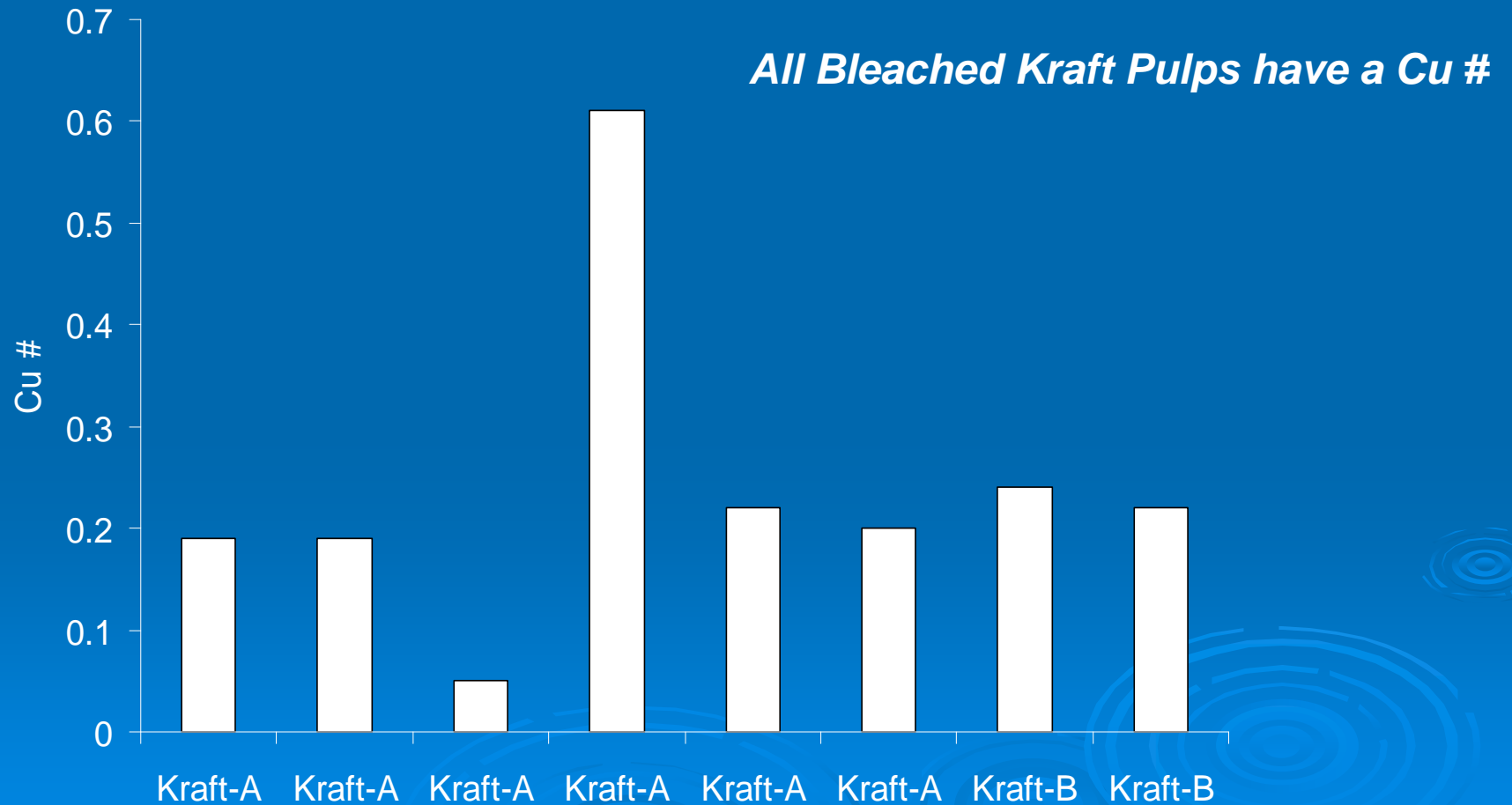
ECF Bleached HW Pulp



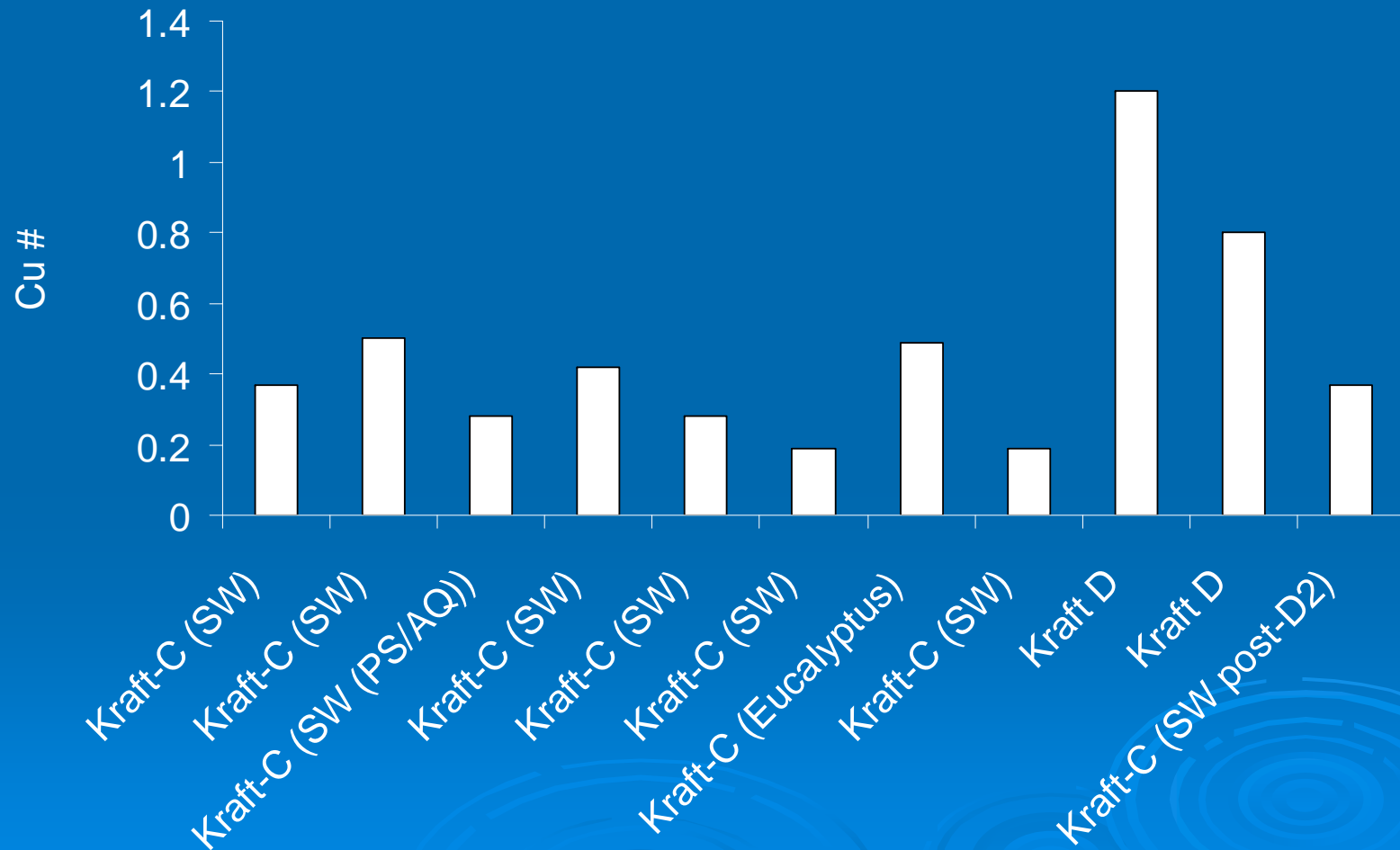
# Preliminary Research Results

- Sulfonation of bleached pulps with elevated Cu # increases WRV up to 50%
- The impacts of these modifications were studied including fiber dimensions, carbonyl, acid groups and their corresponding water absorbency properties as well as morphological changes

# Oxycellulose Content of Kraft ECF Pulps



# Oxycellulose Content of Kraft ECF Pulps



# Proposed IPST@GT Research

- Determine Cu # of a series of ECF bleached kraft pulps and sulfonate Cu # to 0 to increase the WRVs
- Identify best pulps for enhanced cellulosic based superabsorber properties
- Investigate potential to enhance Cu # of ECF bleached kraft pulp via modified peroxide ( $\text{H}_2\text{O}_2/\text{metal}$ ) or alternative oxidant followed by sulfonation and the relationship between the absorbent properties and their chemi-physical properties.



**Thank You**

