

# UTILIZATION OF **LIME SLUDGE AS A FILLER** IN PAPER MAKING- AN INNOVATIVE APPROACH TO COST REDUCTION AND ZERO ENVIRONMENTAL IMPACT

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# How do we get lime sludge?



(Green liquor)

(White liquor) (Lime sludge)

# Options

**Lime sludge is a huge problem... what are options to solve?**

**Tiles, Cement**

**Agricultural, effluent treatment..**

**Fisheries**

**Road-making**

**... then we thought of paper**

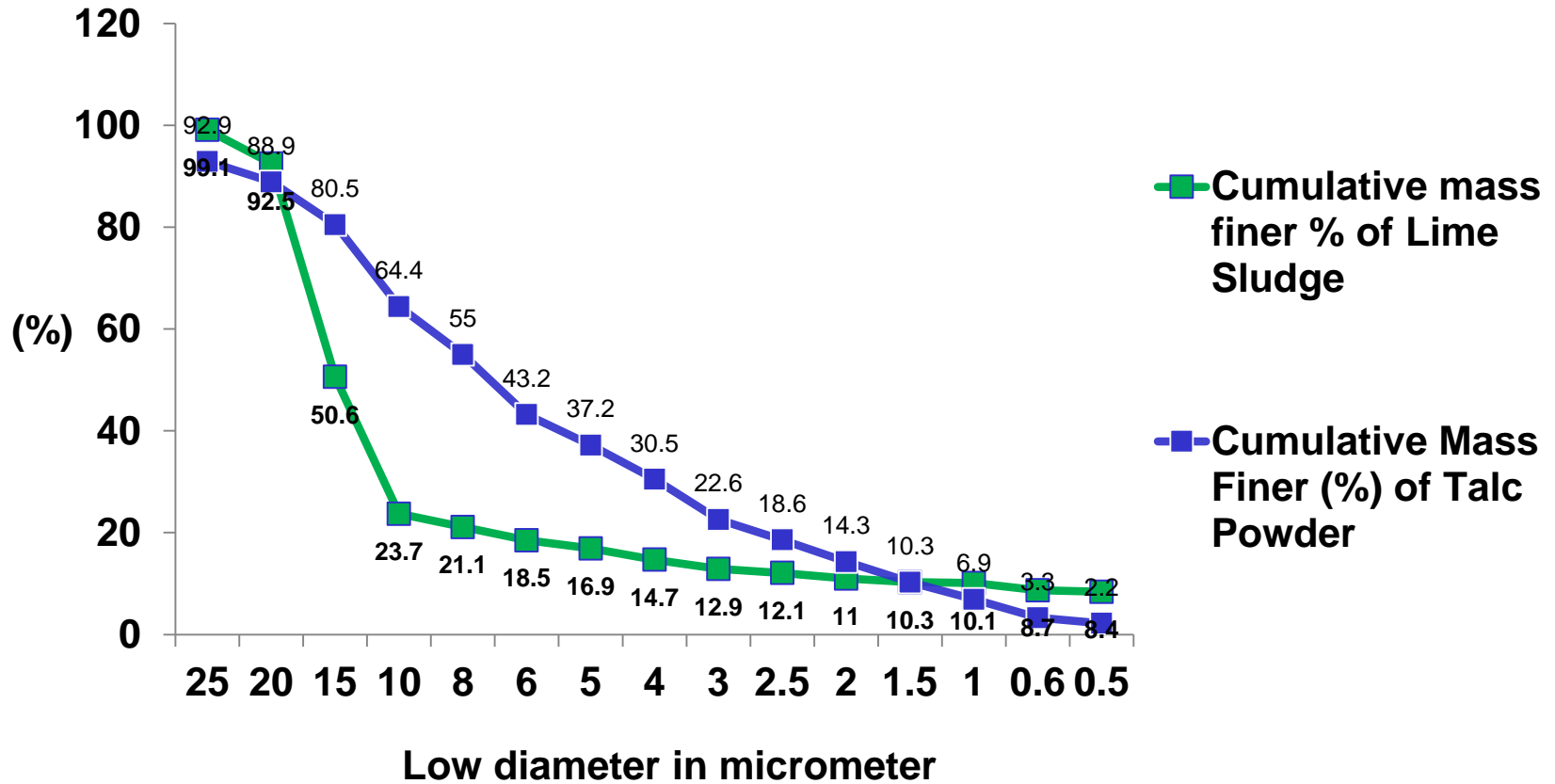
# We compared the filler properties of TALC AND LIME SLUDGE

Parameter	Talc (Soap stone)	Lime sludge
Calcium carbonate CaCO <sub>3</sub> ,%w/w	-	85
Silica SiO <sub>2</sub> , %w/w	42.36	4.06
Residual CaO%,w/w	0.23	0.13
Residual NaOH%,w/w	-	0.6
Mixed Oxide as R <sub>2</sub> O <sub>3</sub> .%w/w	0.37	2.59
Loss on Ignition,%	4.27	40.1
Acid solubility,%	4.15	90.13
Brightness %ISO	84	82
Abrasiveness' (mg/m <sup>2</sup> )	0.39 (1900 rpm for 24 min)	0.23 (1,70.000 revolution)
Sulfate,%	—	1.62

# Results

**Chemical properties are different...  
but the effect on paper is very  
similar.**

# Particle Size Distribution of Lime sludge & Talc



**So we wondered... If lime sludge is so similar to talc, can we use it as filler?**

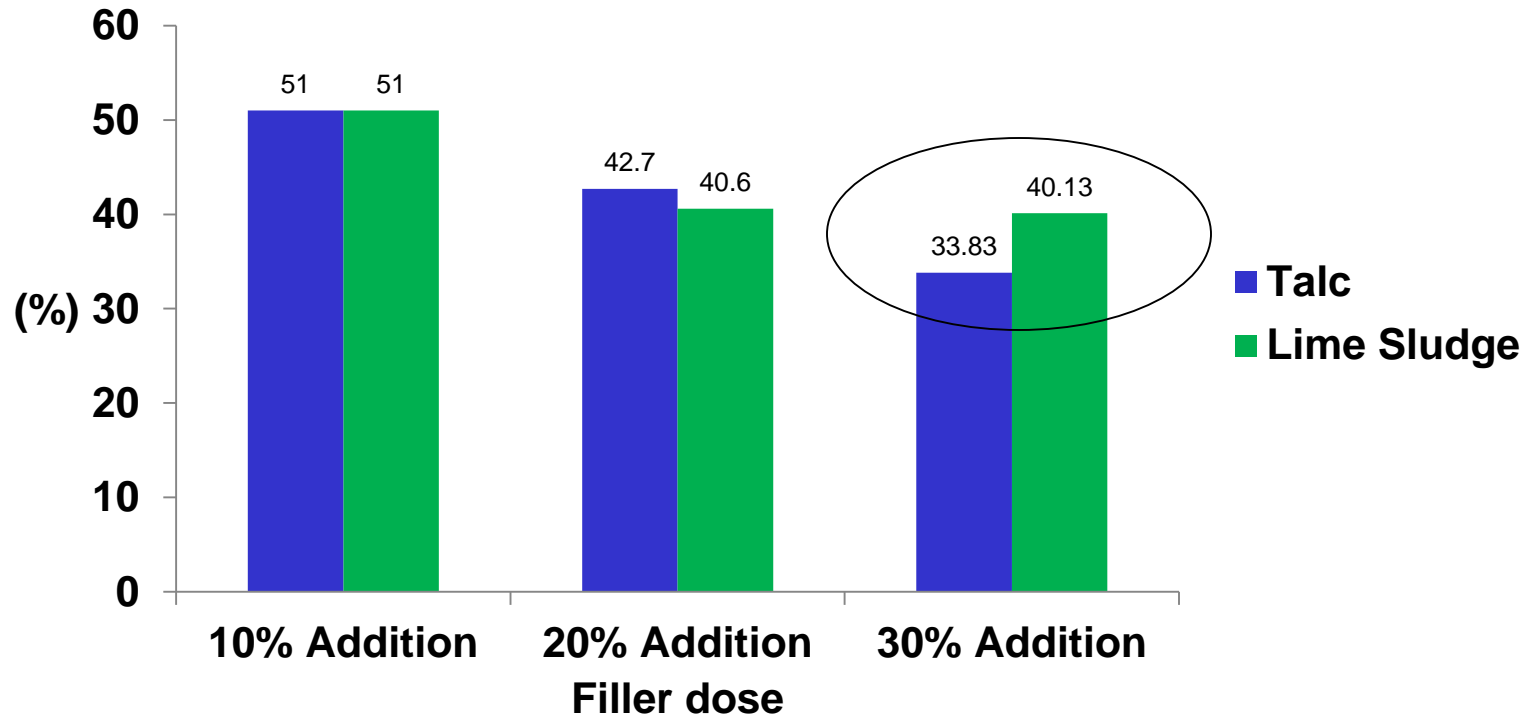
# Our three experiments

Exp 1	Exp 2	Exp 3
<p>30 gm OD pulp+ 2% AKD + 30% <b>LIME SLUDGE</b> &amp; TALC</p>	<p>30 gm OD pulp+ 2% AKD + 30% LIME SLUDGE &amp; TALC &amp; 50:50 LS/TC+ <b>0.2% Cationic rosin</b></p>	<p>30 gm OD pulp+ 2% AKD + 32% LIME SLUDGE &amp; TALC &amp; 50:50 LS/TC+ 0.2% Cationic rosin+ <b>20% Starch</b></p>



**What were our results?**

## Ash % Retention

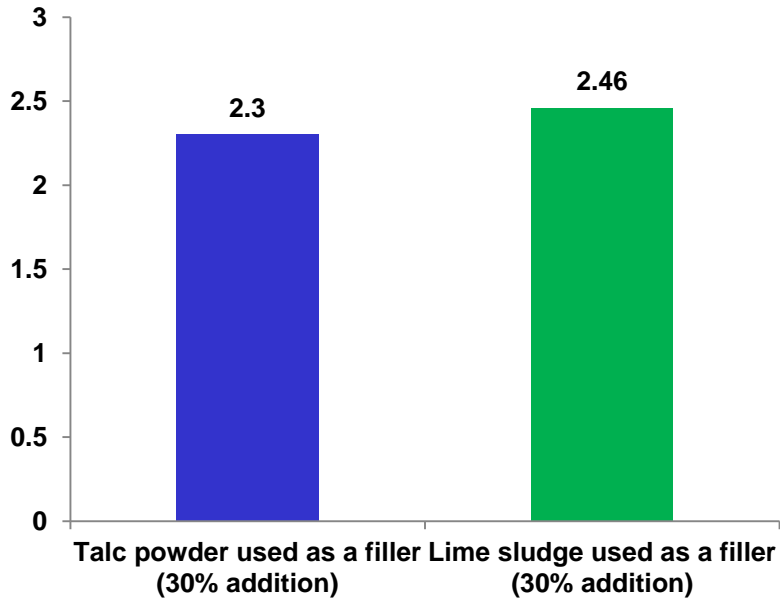


# Results

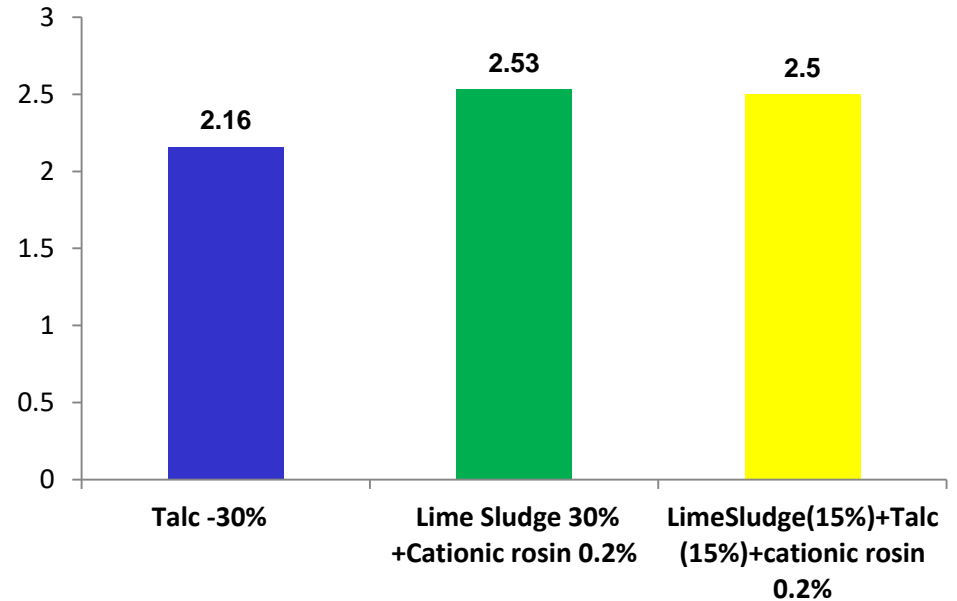
**Lime sludge out performs talc at 30% filler addition as retention is concerned.**

## Then we tested bulk...

Exp 1



Exp 2

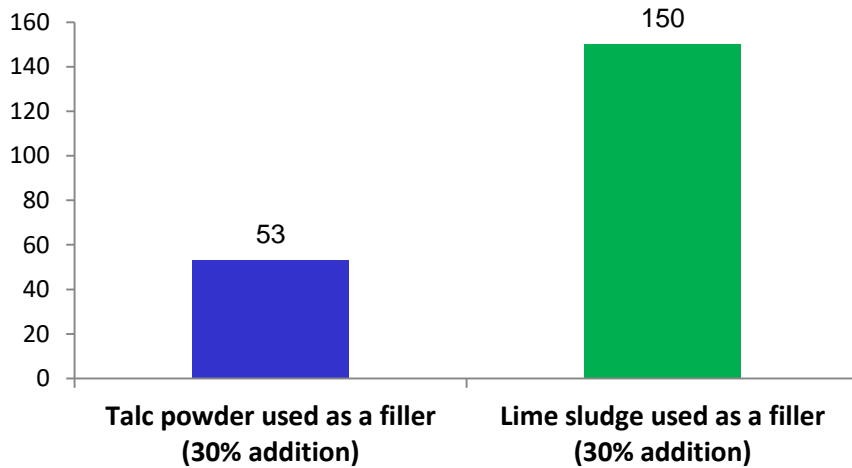


# Results

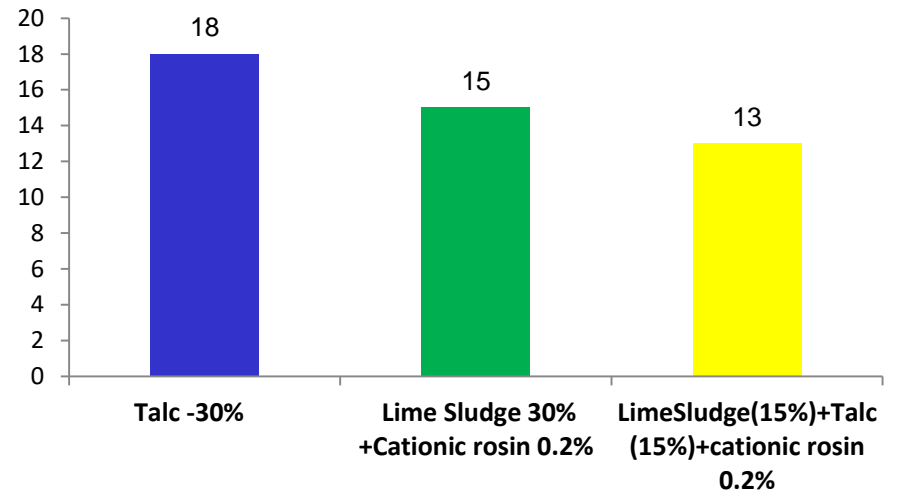
**Again lime sludge is better**

# We tested cobb in three experiments

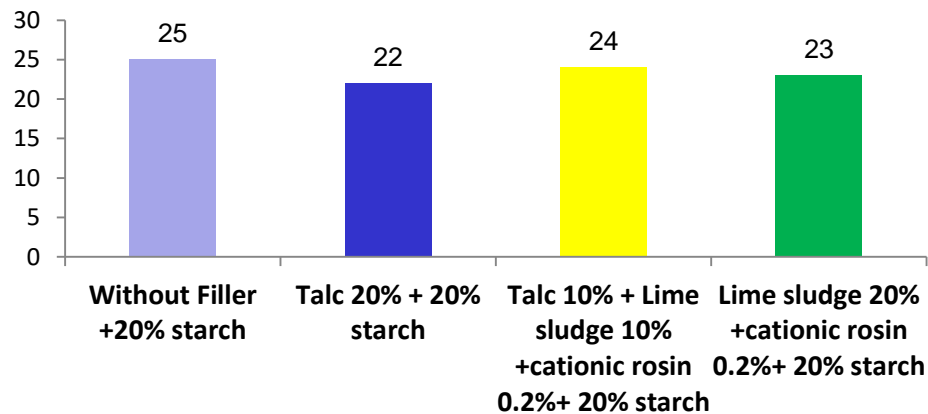
## Exp 1



## Exp 2



## Exp 3

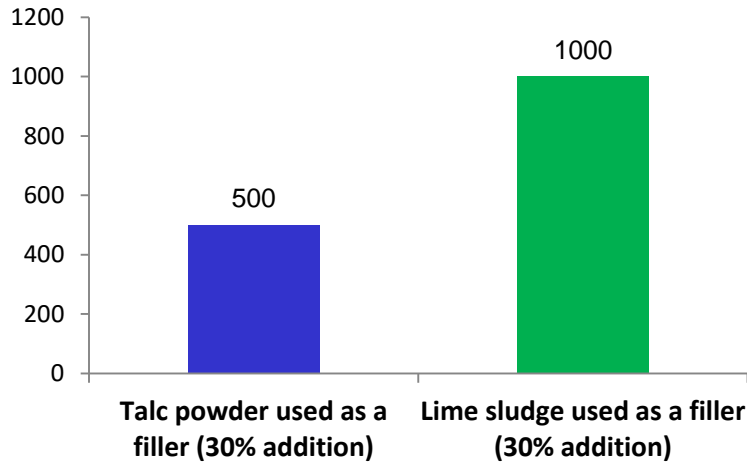


# Results

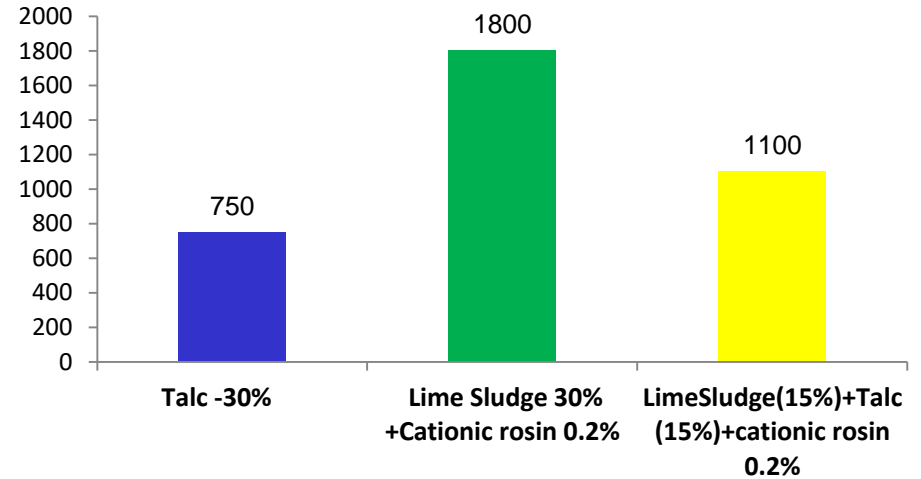
**We get similar or more water resistance after using cationic rosin along with lime sludge.**

# We tested porosity three experiment

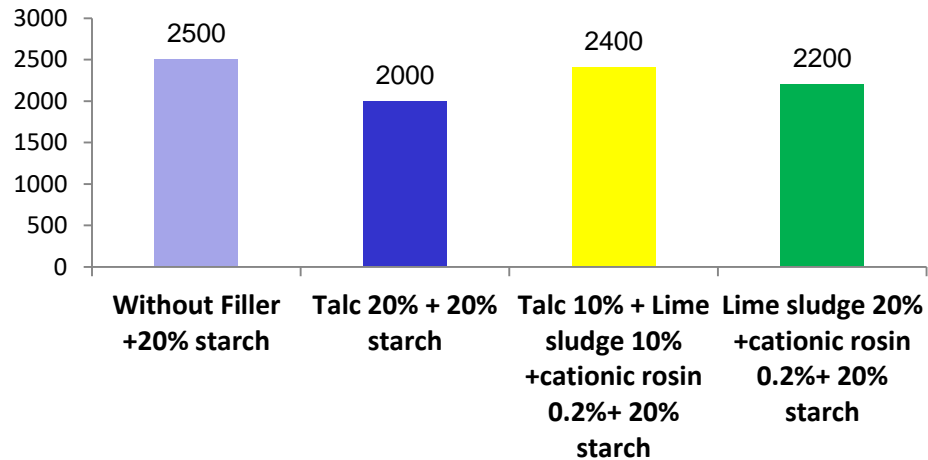
## Exp 1



## Exp 2



## Exp 3

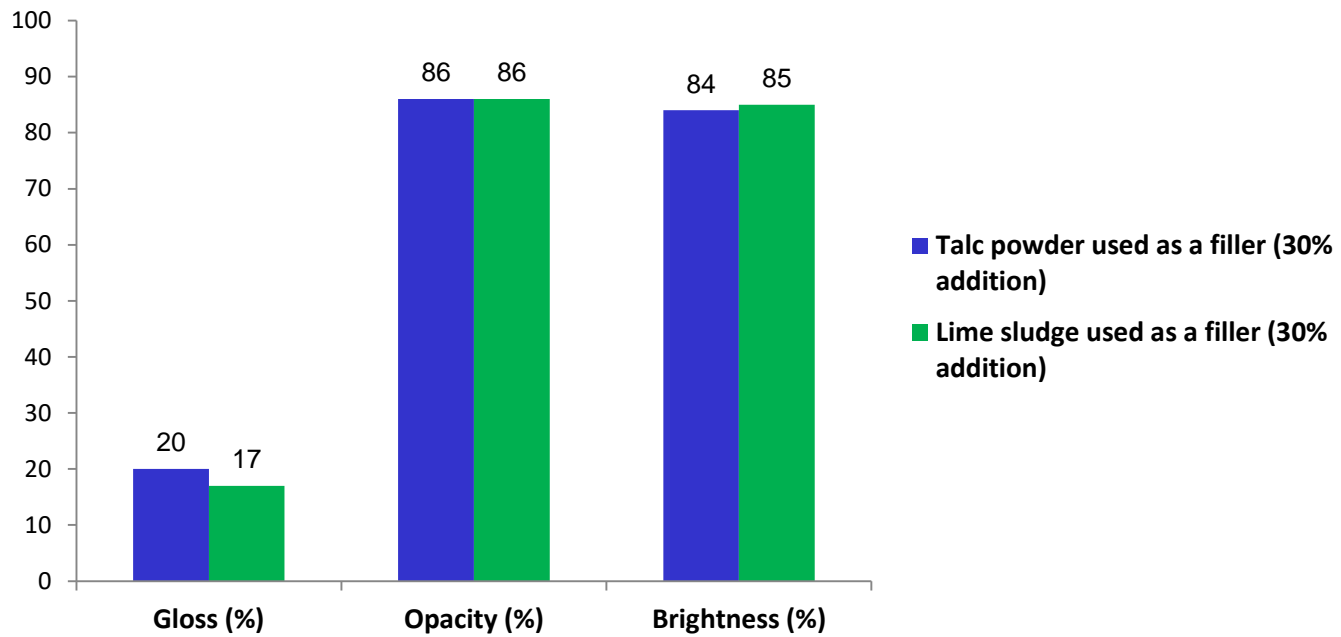




# Results

**Porosity increases when we use lime sludge....so we used starch to fill.**

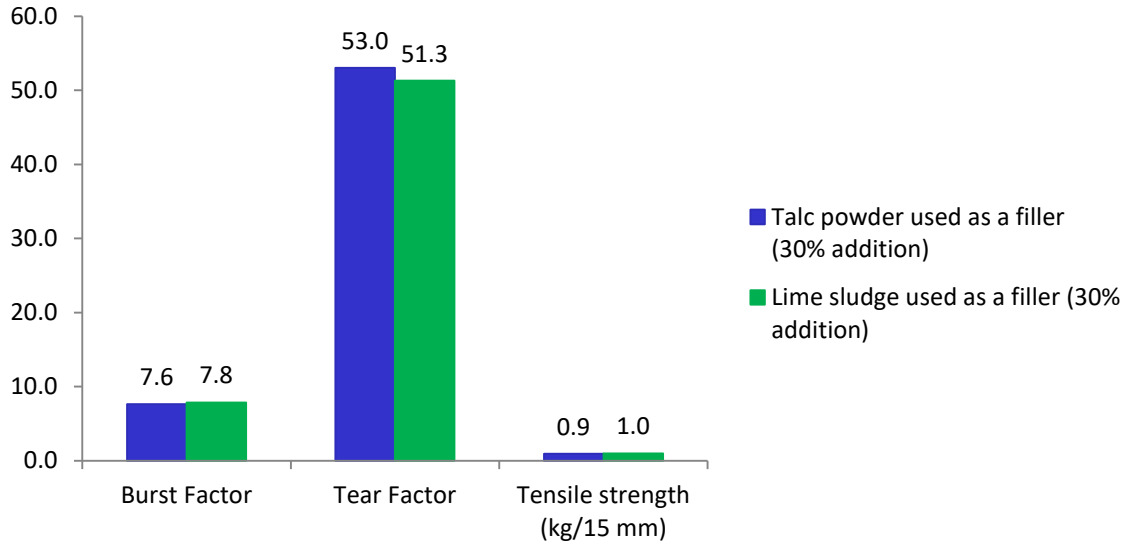
## We tested optical Properties



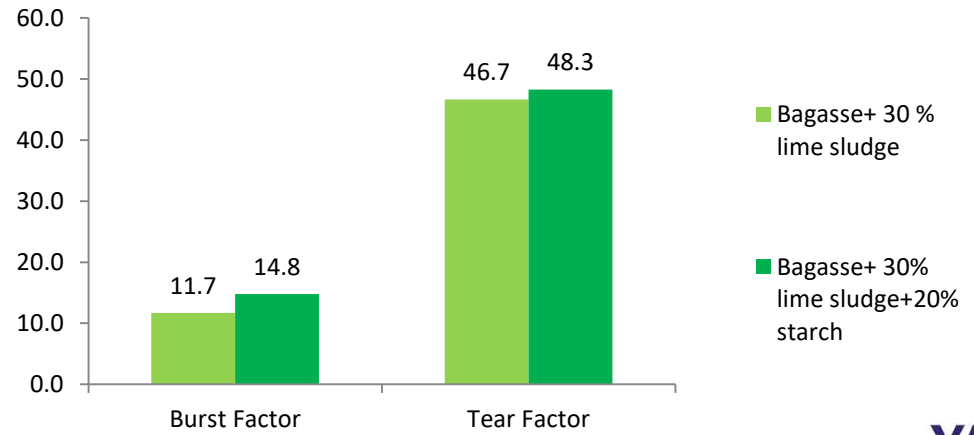
# Results

**Lime sludge & talc are similar**

## We tested Strength Properties



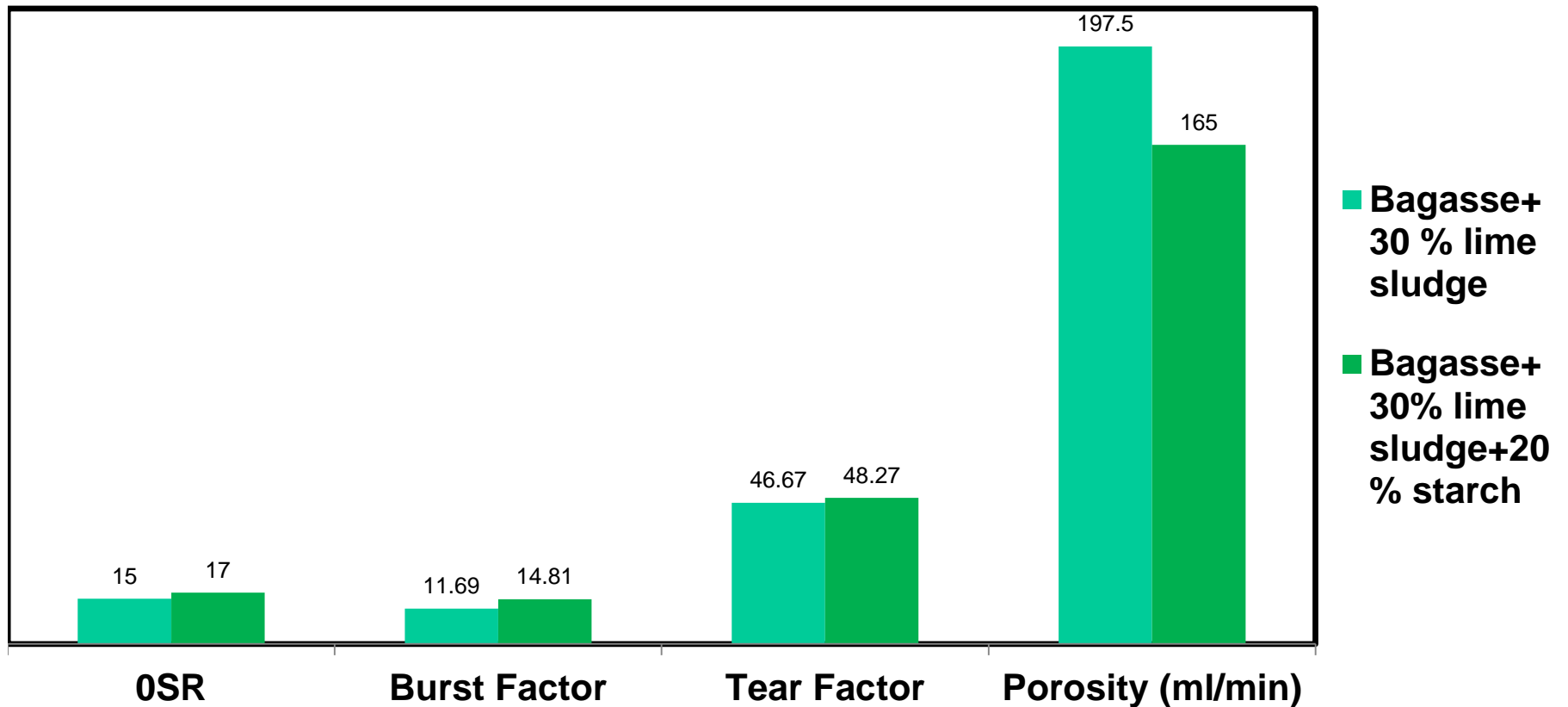
## Strength Properties with & without starch



# Results

**Very similar....But interesting....when combined with starch the burst & tear factor increases while the porosity of sheet reduces.**

## Lime sludge Vs Lime sludge with starch



# Results

**Lime sludge with starch is best**

# Conclusion

- **Laboratory scale trials have proved that the lime sludge can be definitely used as a filler in paper making either exclusively or in combination with soap stone without any adverse effect on paper properties.**
- **Encouraged by positive findings, Yash papers Ltd proposes to conduct a plant scale trial very soon.**
- **If successful, this application will help industry to achieve the twin objectives of getting a low cost substitute for fillers in paper while avoiding solid waste disposal problems which are a great challenge at present.**



# Suggestions !!!