Alkaline pretreatment and saccharification of woody biomass: Castor Stalk

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Santosh Sankh

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Introduction

Non Conventional

- Fossil fuels - Limited availability
- Global Warming
  (Rising Environmental Pollution /GHG emissions)
- Crude oil - Price up & Decrease supply
- Need of alternative renewable materials



Need of Bio energy for cleaner tomorrow

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Advantages of Biofuels

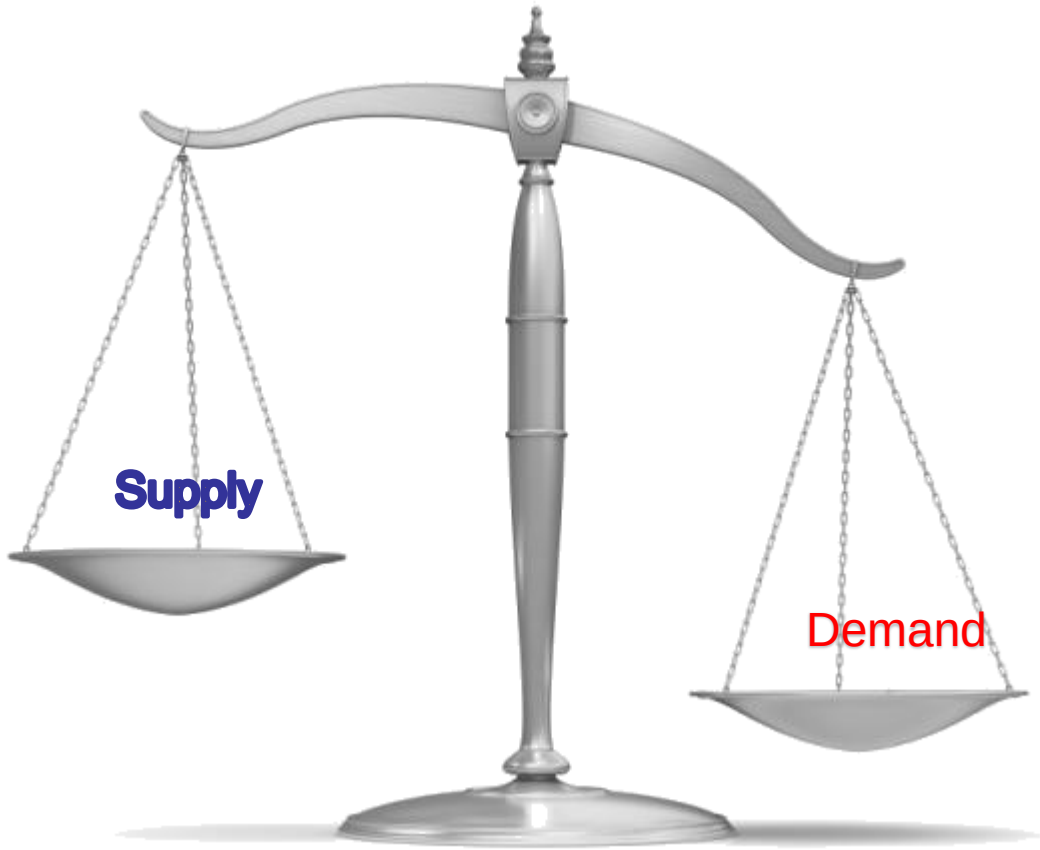
- Security of supply
- Reduction of green house gas emmision
- Regional or rural development
- Can be blended

"*The use of vegetable oils for engine fuels may seem insignificant today, but such oils may become in course of time as important as petroleum and the coal tar products of the present times*"
- Rudolf Diesel at the Engg Society of St. Louis, 1912

Designed diesel engine in 1894 to run on peanut oil

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Imbalance in supply and demand of fuel



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Cause of demand: An example



Transformation



Increase in urbanization
Change in lifestyle
Usage of fuel driven transport

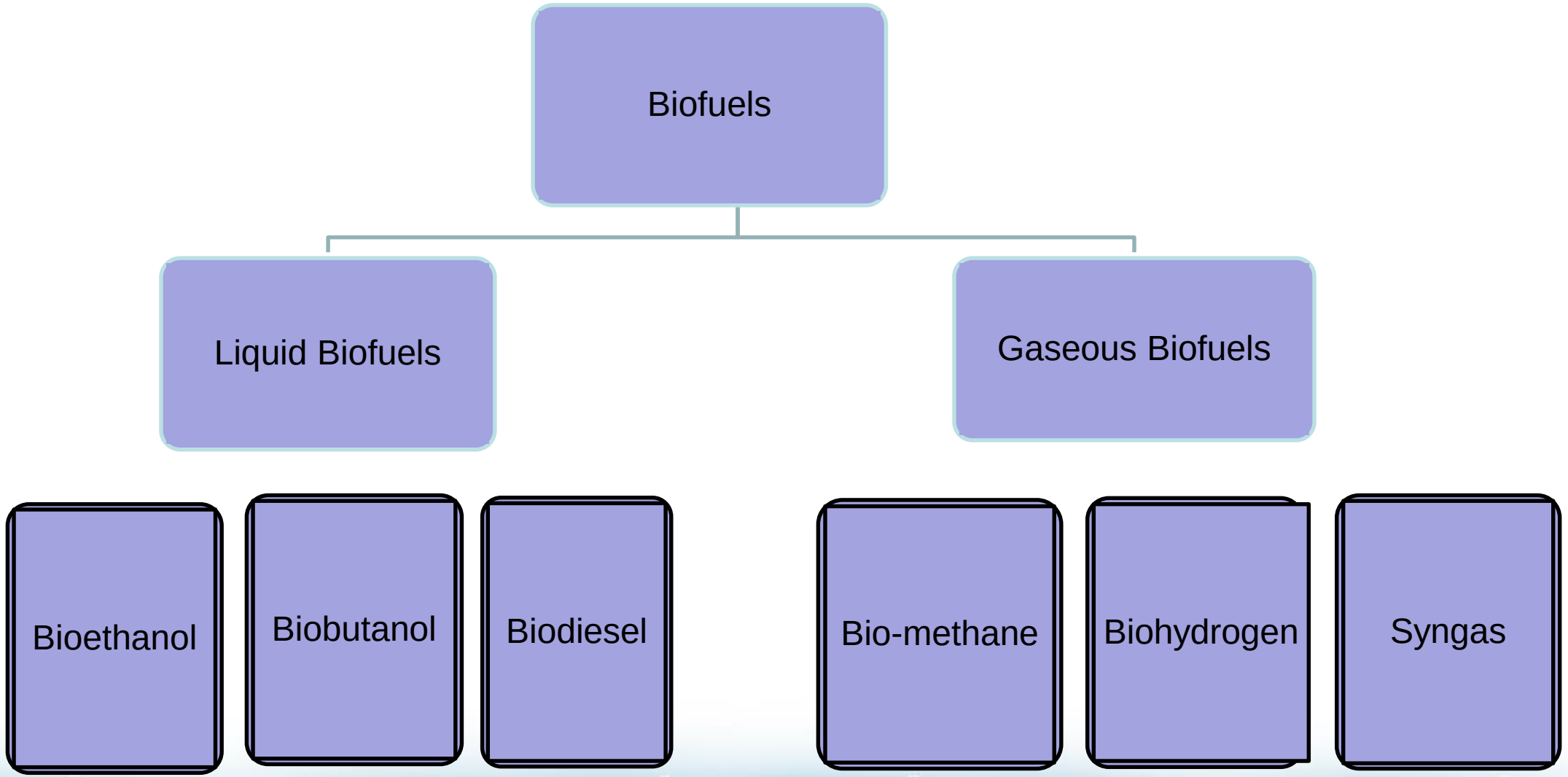
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Solution for energy crisis : Biofuel



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Classification of Biofuels



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Second Generation Substrates: Lignocellulosic Biomass



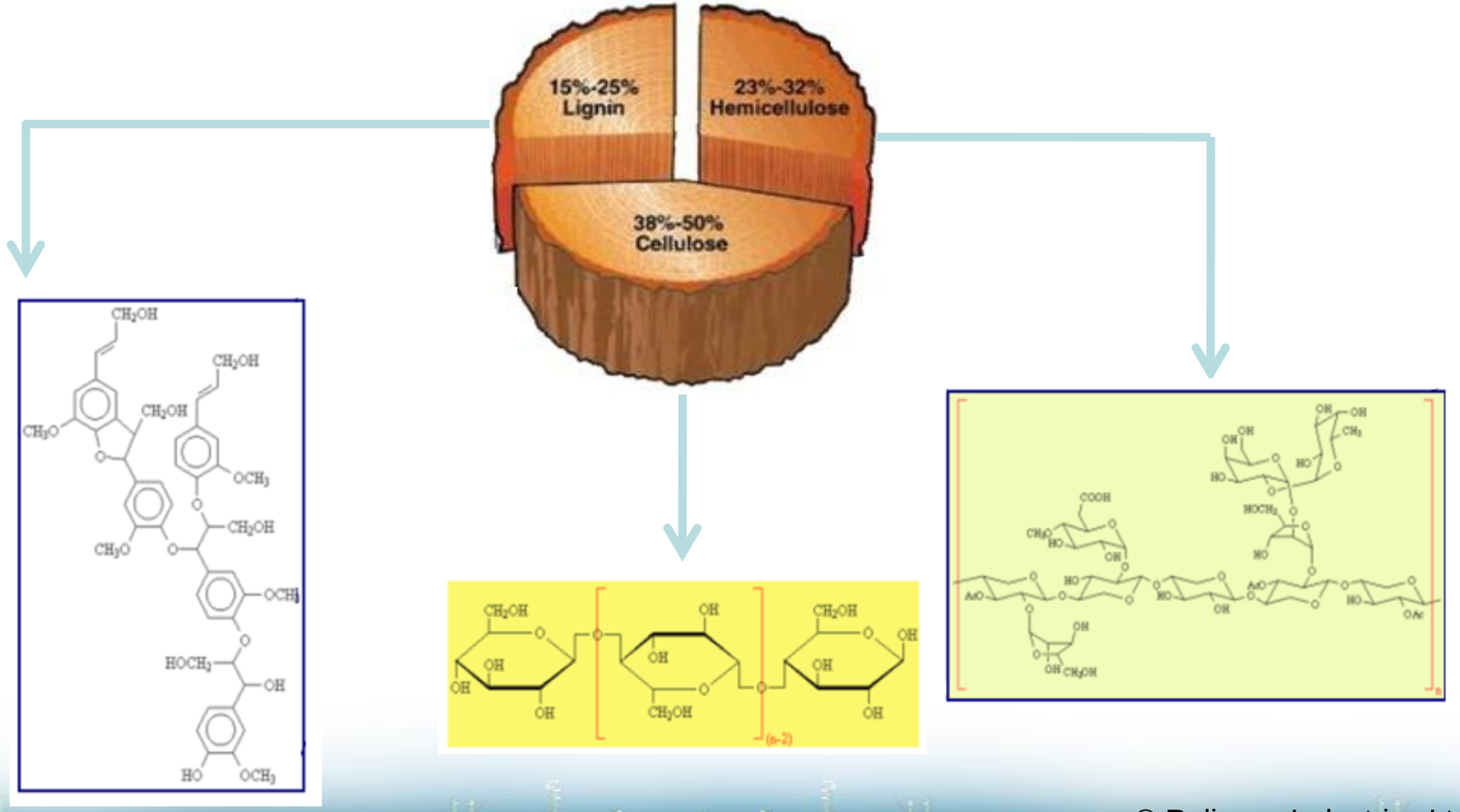


LIGNOCELLULOSICS: a better alternative

- Can be grown on barren uncultivable land
- Need less amount of water to grow
- Does not interfere with food chain
- Available in ample amount

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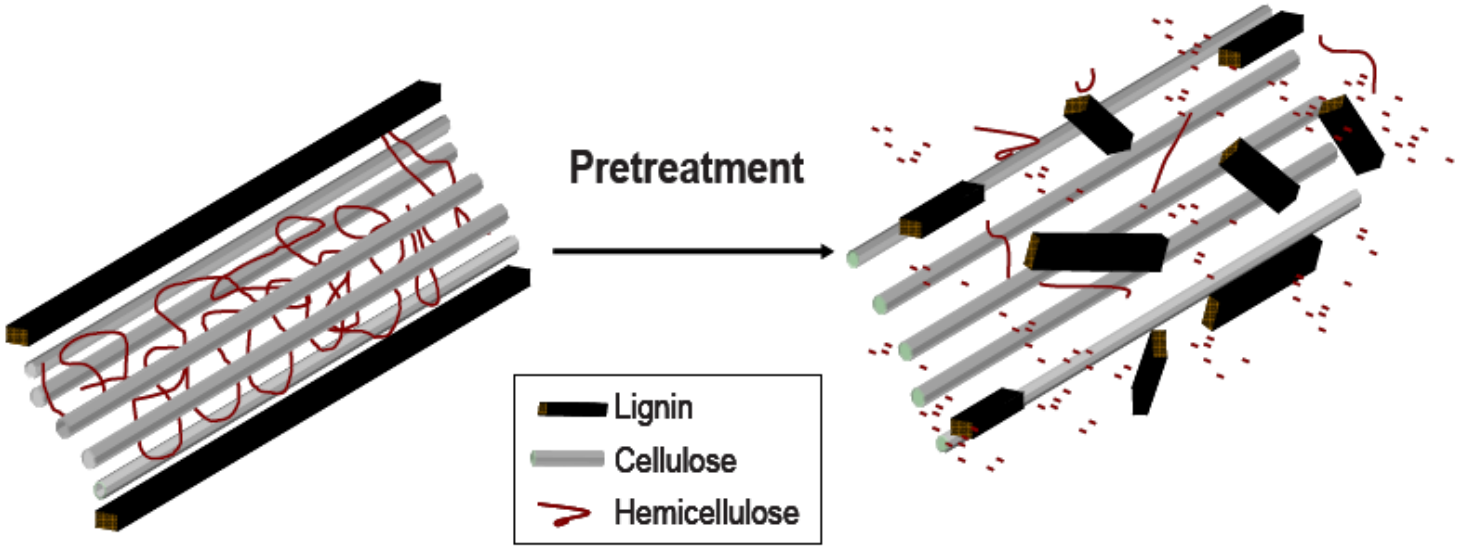
Composition of lignocellulosic biomass



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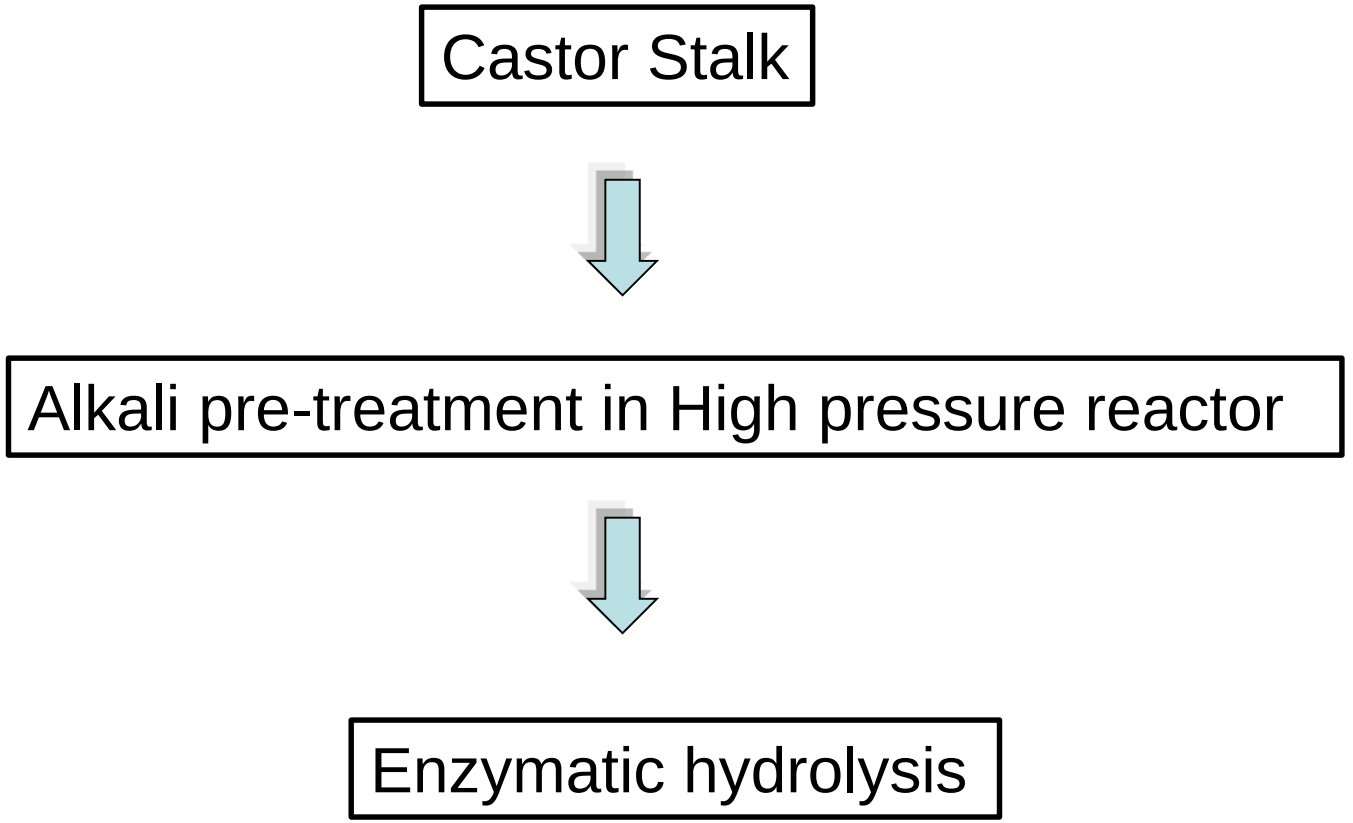
Different techniques of biomass pretreatment

- Physical method
- Chemical methods
- Biological methods



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Flow sheet of Castor Stalk pretreatment and hydrolysis



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Composition of Castor Stalk

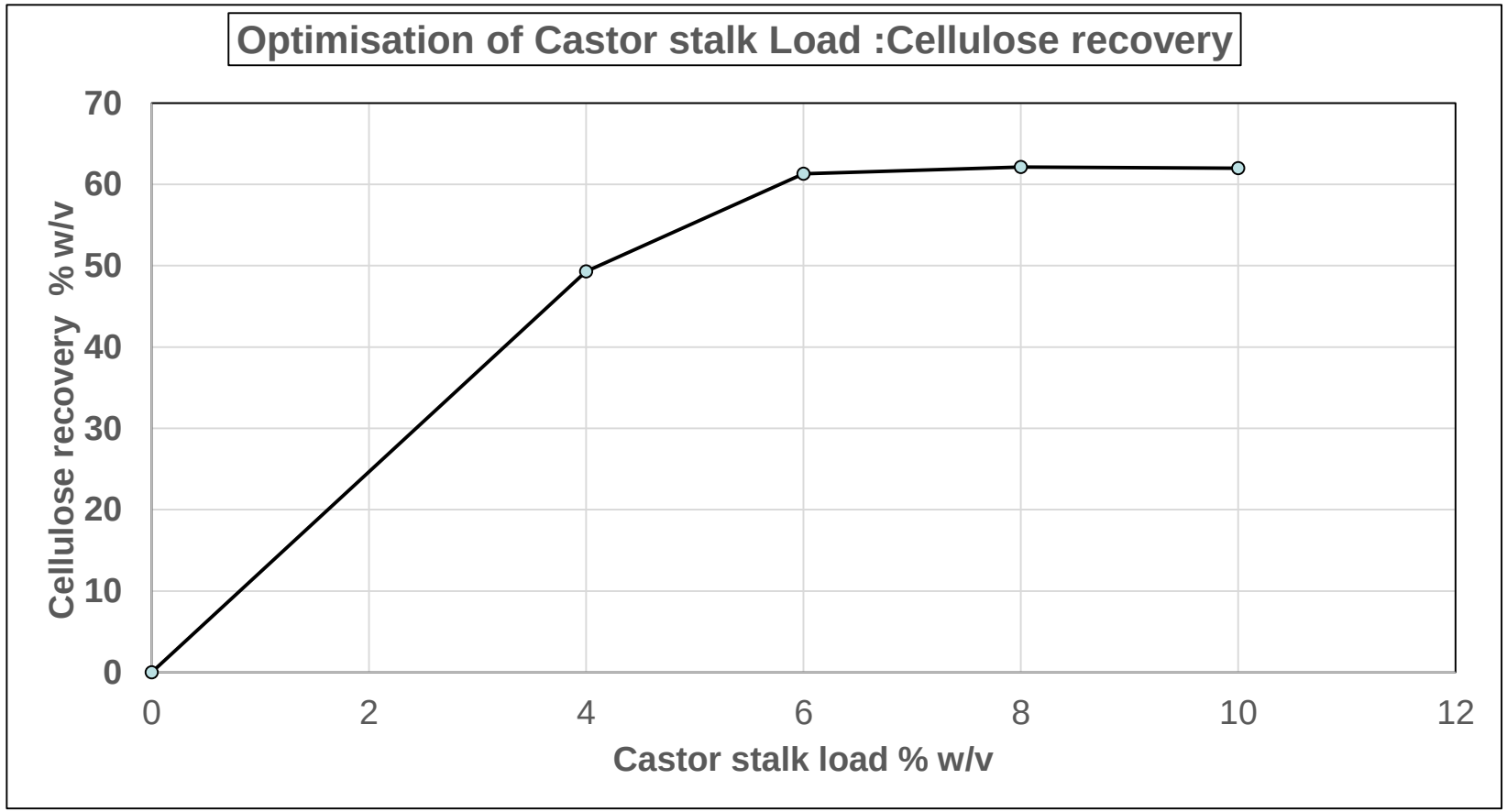
Composition	% w/v
Cellulose	43.45
Hemicellulose	16.01
Lignin+ Ash	29.22

Composition analysis was carried out by NREL protocol



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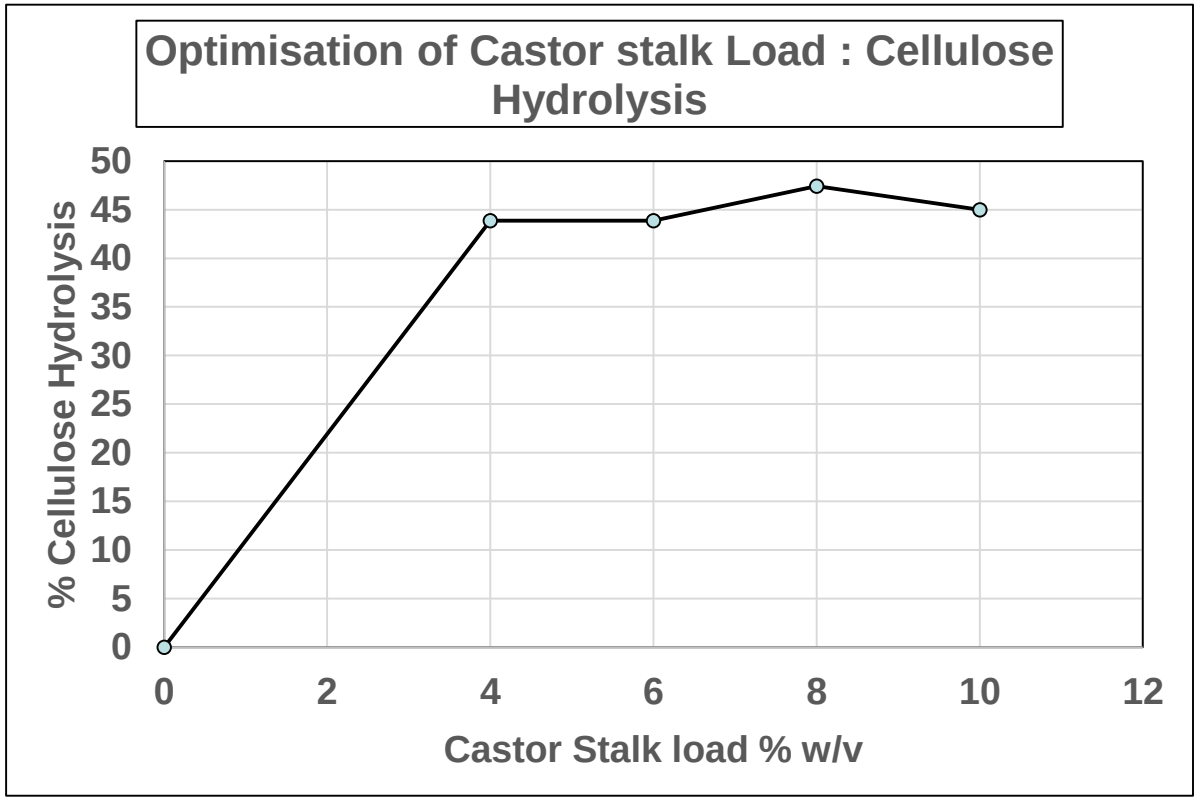
Optimisation of Castor stalk load



Optimum cellulose recovery at 8 % w/v biomass load

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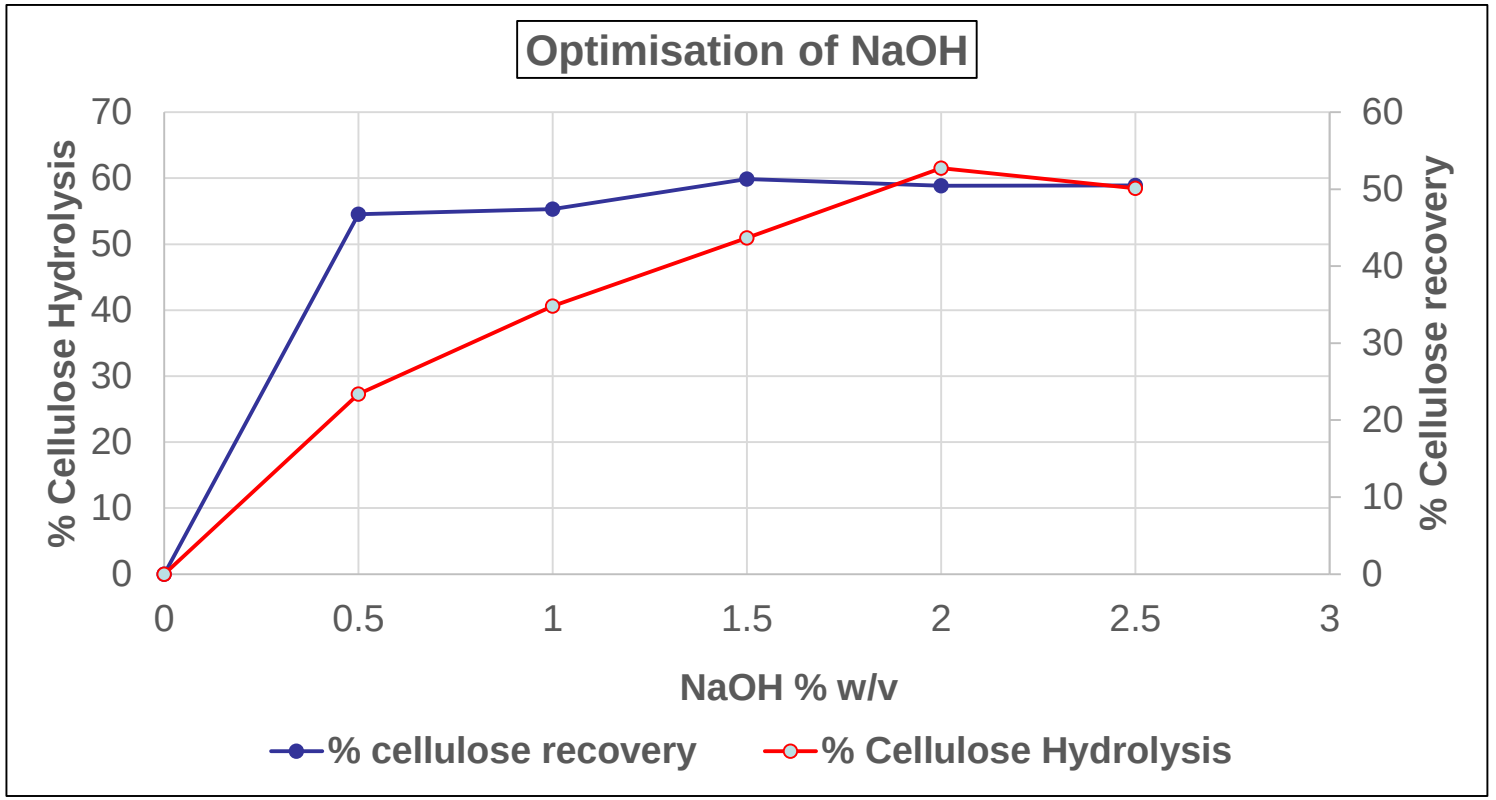
Optimisation of Castor stalk load



Optimum cellulose hydrolysis at 8 % w/v biomass load

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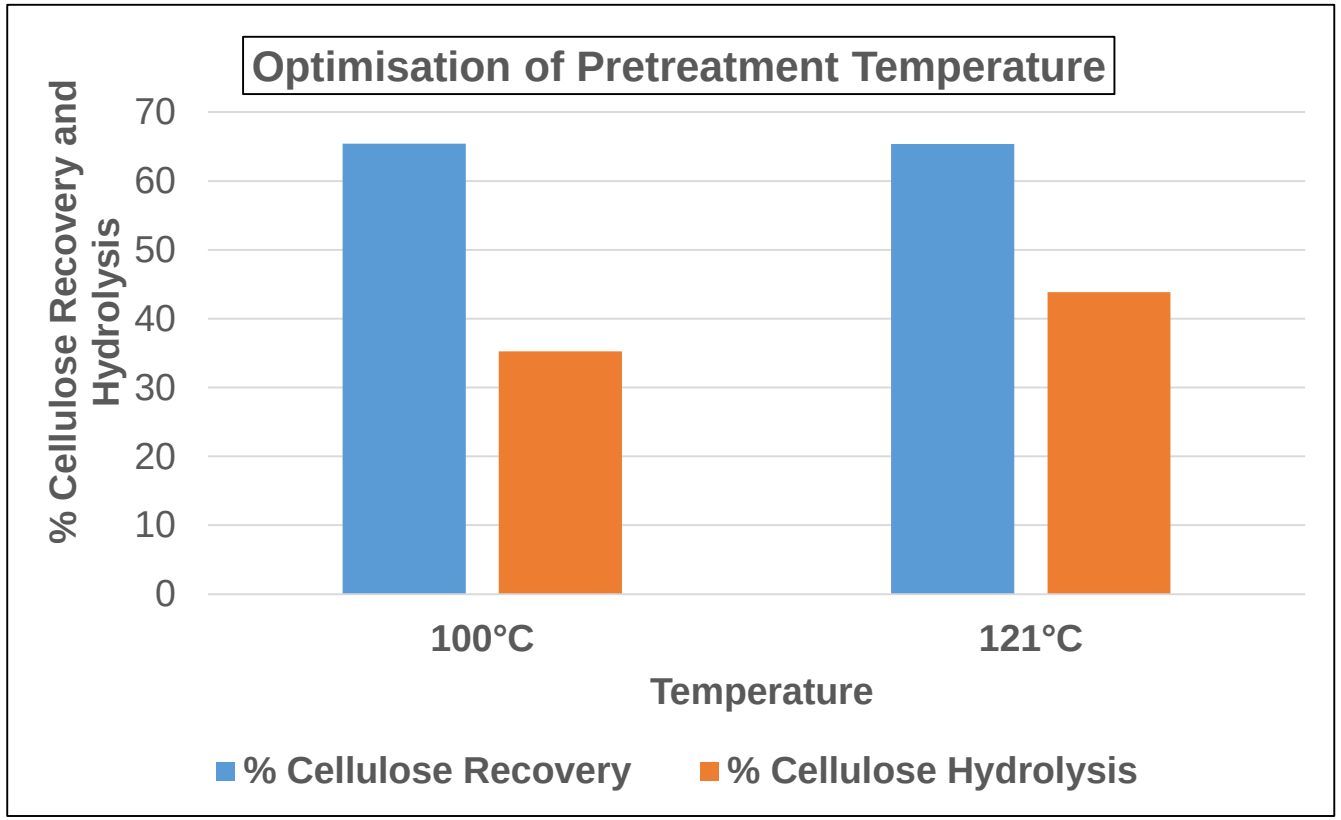
Optimisation of Sodium hydroxide Concentration



Optimum cellulose recovery at 1% w/v NaOH Concentration

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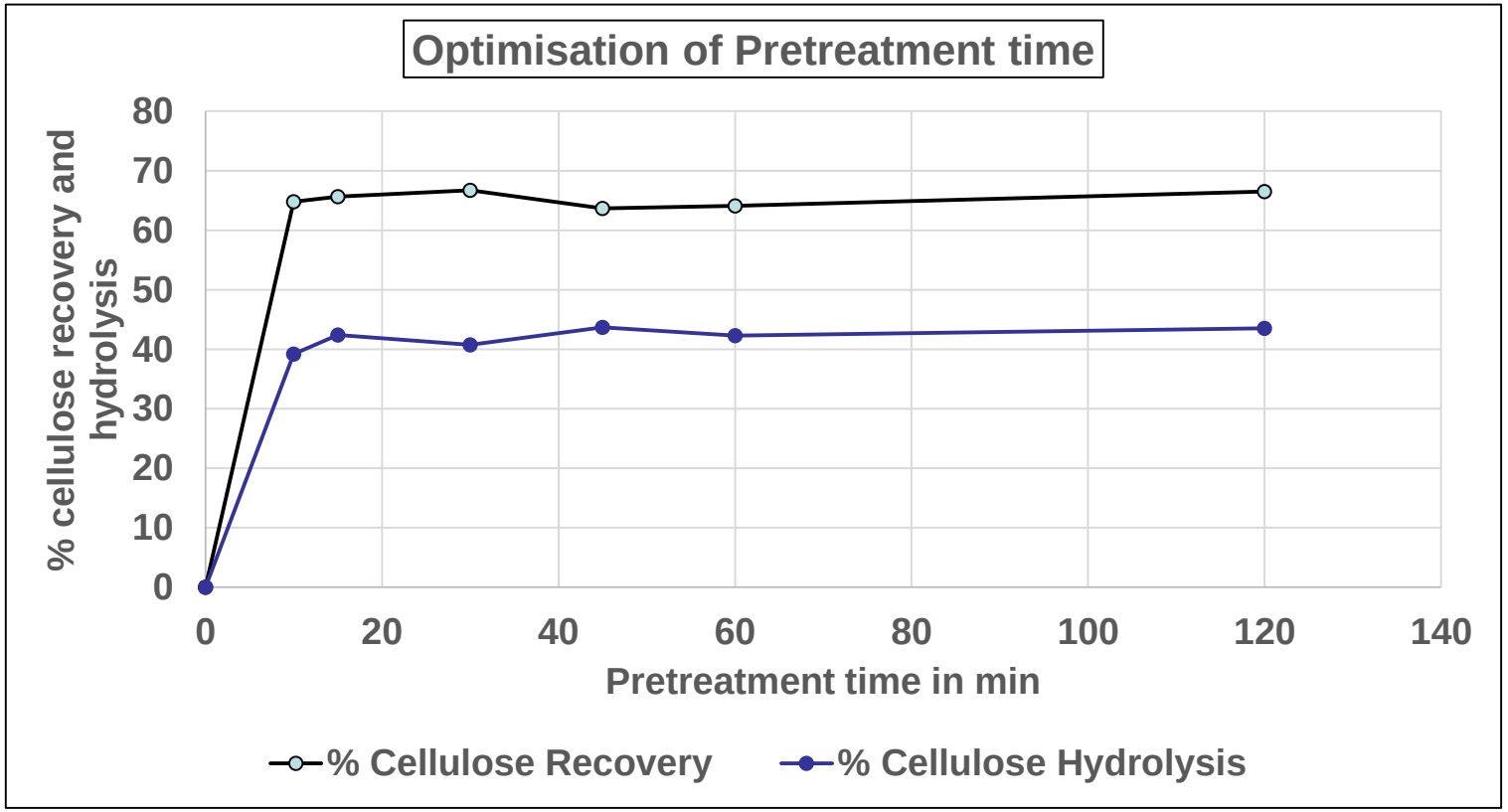
Optimisation of Pre-treatment temperature



Optimum cellulose recovery and hydrolysis was observed at 121 °C

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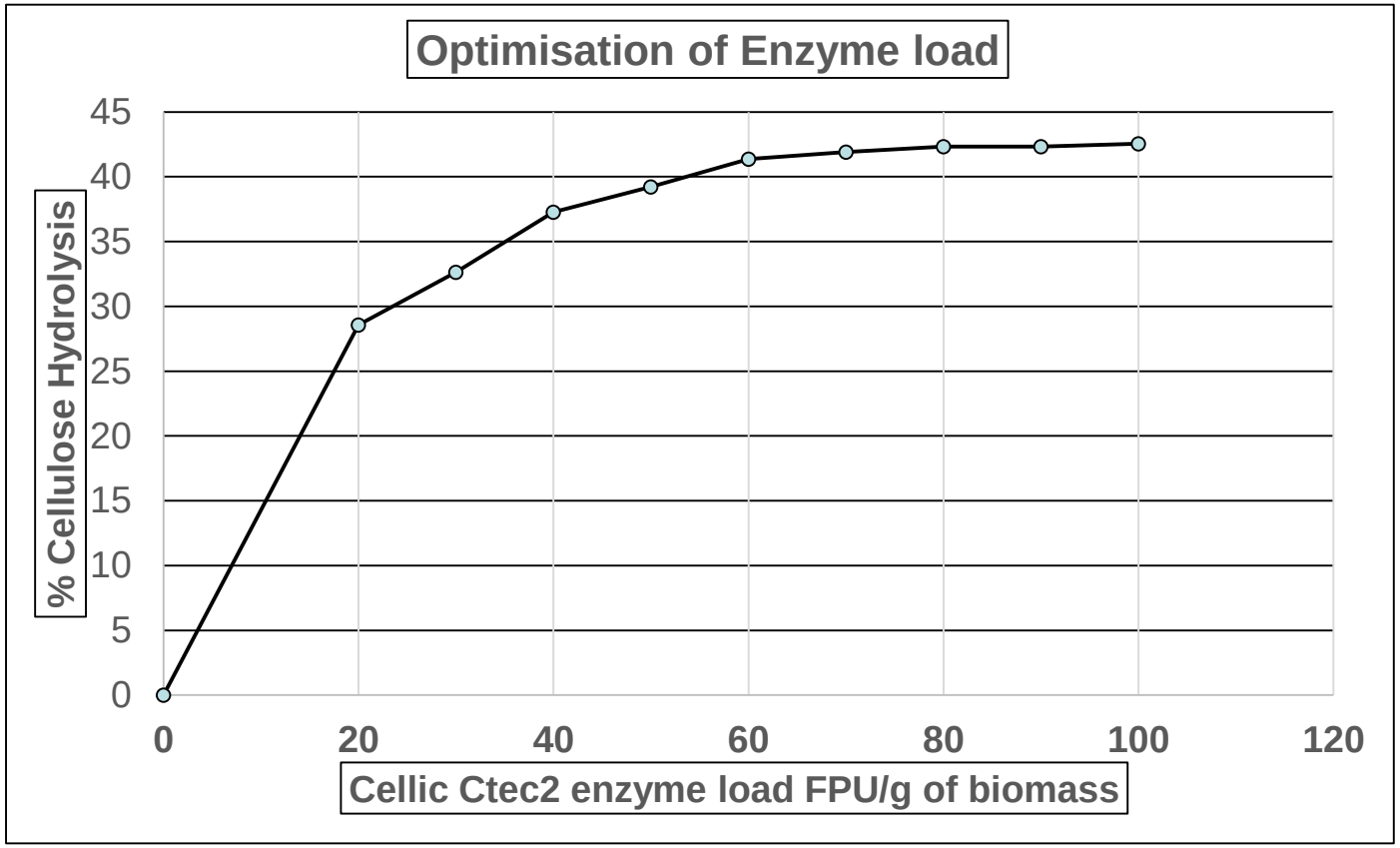
Optimisation of Pre-treatment time



Optimum cellulose recovery and hydrolysis was observed at 121 °C/15 min time

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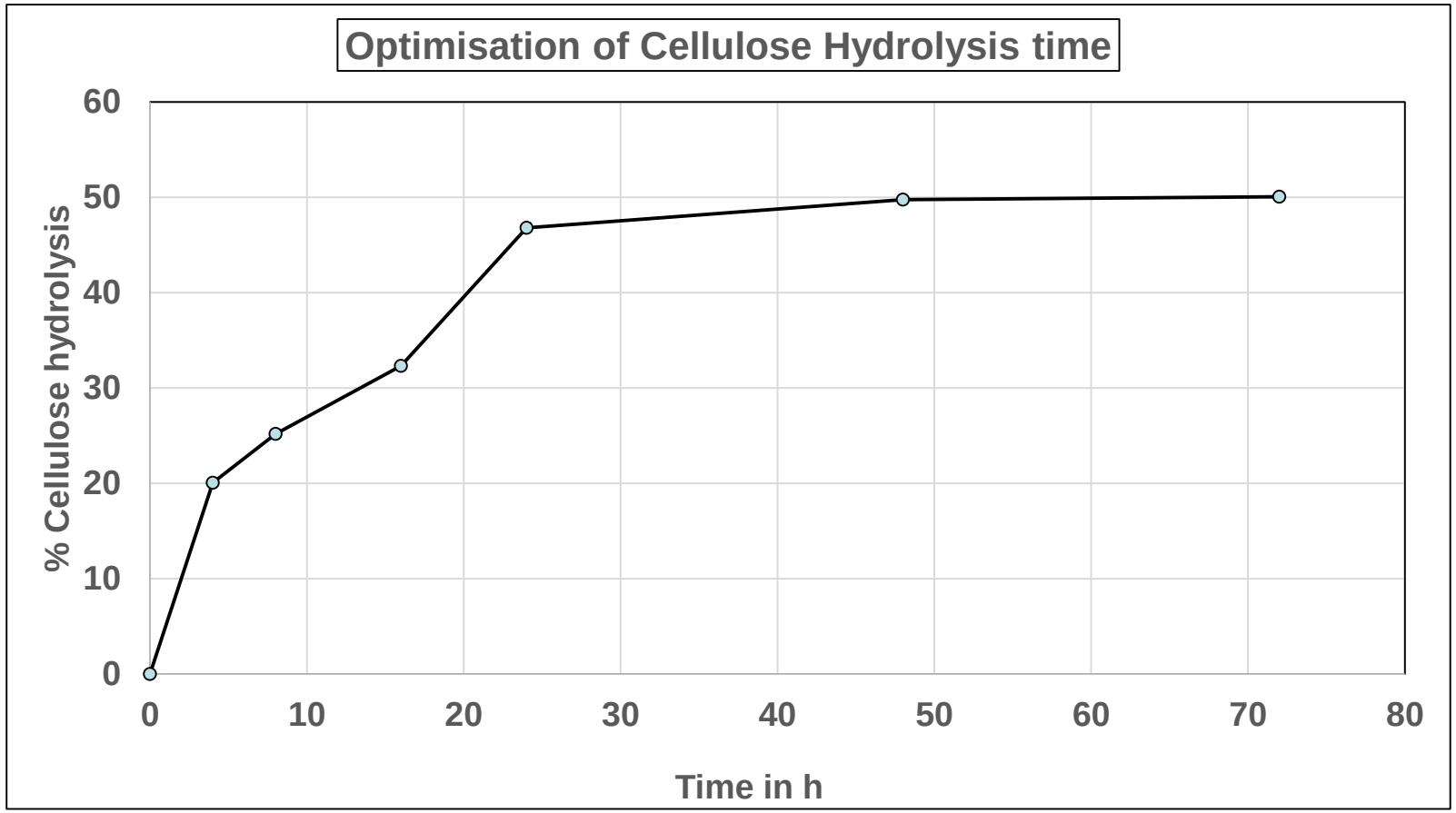
Optimisation of Enzyme load for pulp hydrolysis



Optimum pulp cellulose hydrolysis was observed with 50 FPU enzyme load

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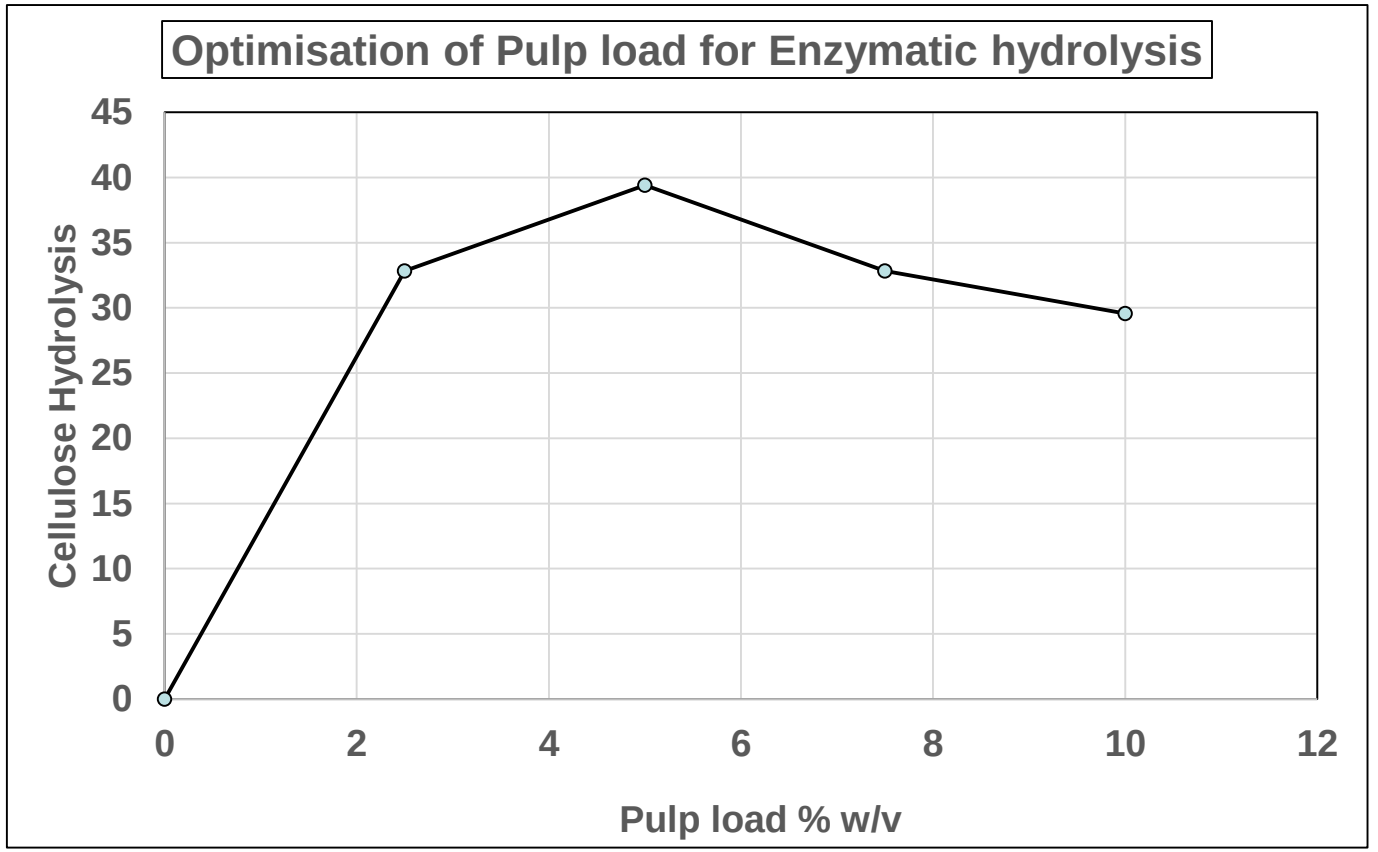
Optimisation of Enzymatic hydrolysis time



Optimum pulp cellulose hydrolysis was observed with 50 FPU Cellic Ctec2 /gm of biomass load at 24 hrs

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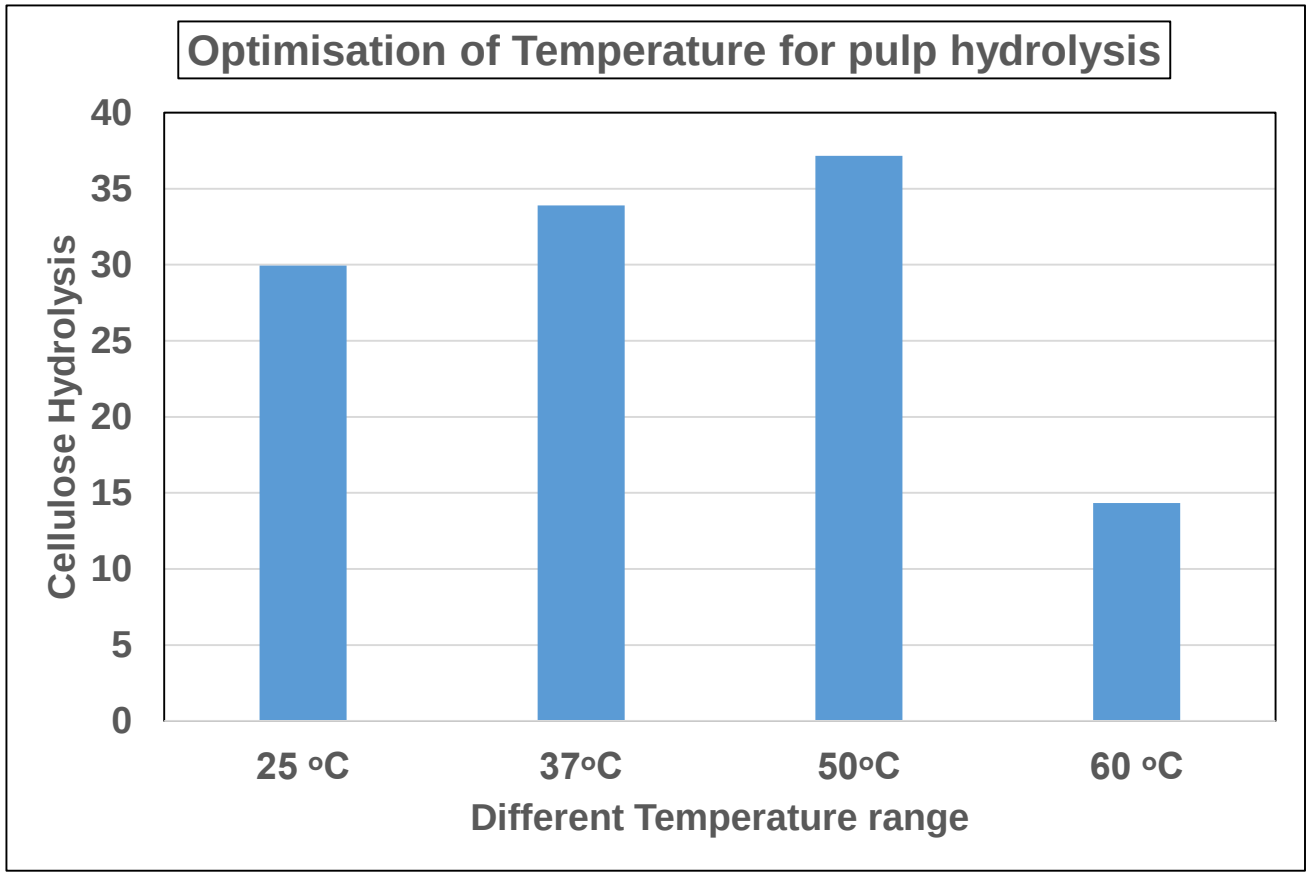
Optimisation of pulp load for Enzymatic hydrolysis



Optimum pulp cellulose hydrolysis was observed with 5% w/v pulp load

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Optimisation of temperature for enzymatic hydrolysis time



Optimum pulp cellulose hydrolysis was observed at 50°C

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Conclusions :Optimised Conditions

- Biomass load : 8% w/v
- Pre-treatment time : 15 min
- Pre-treatment temperature :121°C
- Alkali load :1% w/v
- Enzyme load : 50FPU
- Enzyme hydrolysis time : 24 h
- Optimum temperature for enzyme : 50°C
- Optimum pulp load : 5% w/v

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Thanks

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