

Background

- Paper sludge (PS) waste originates from treatment of wastewater at pulp and paper mills
- Current disposal methods: landfilling or incineration
- Alternative waste management practices necessary
- PS waste ideal for 2G ethanol → no pretreatment required
- Submerged, fed-batch fermentation in conventional stirred reactors → 40 to 50 g/L ethanol
- High-solids fermentation in horizontal reactors can improve abovementioned ethanol titres
- Engineered cellulase-secreting yeast strains can reduce exogenous enzyme requirements & cost of 2G ethanol

Aim & Objectives

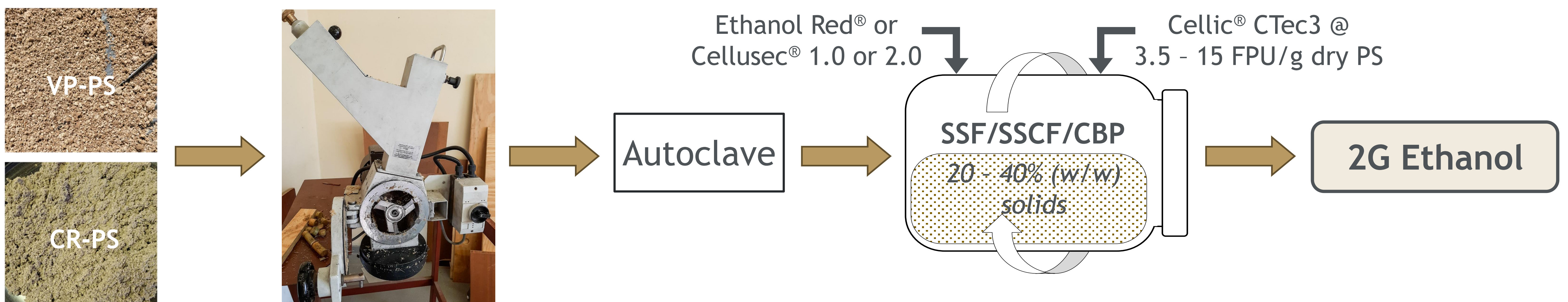
Aim of study:

- Maximise ethanol titre and yield for hydrolysis-fermentation of PS waste emanating from processes for virgin pulp (VP-PS) and corrugated recycle (CR-PS) via high-solids, batch SS(C)F processes.

Objectives of study:

- Assess ethanol production from CR-PS & VP-PS at 20-40% (w/w) solids and 5-15 FPU/g dry PS enzyme dosage with Ethanol Red®
- Demonstrate benefits of xylose utilisation using Cellusec® 1.0
- Reduce exogenous enzyme requirements using Cellusec® 2.0

Ethanol production process



Results

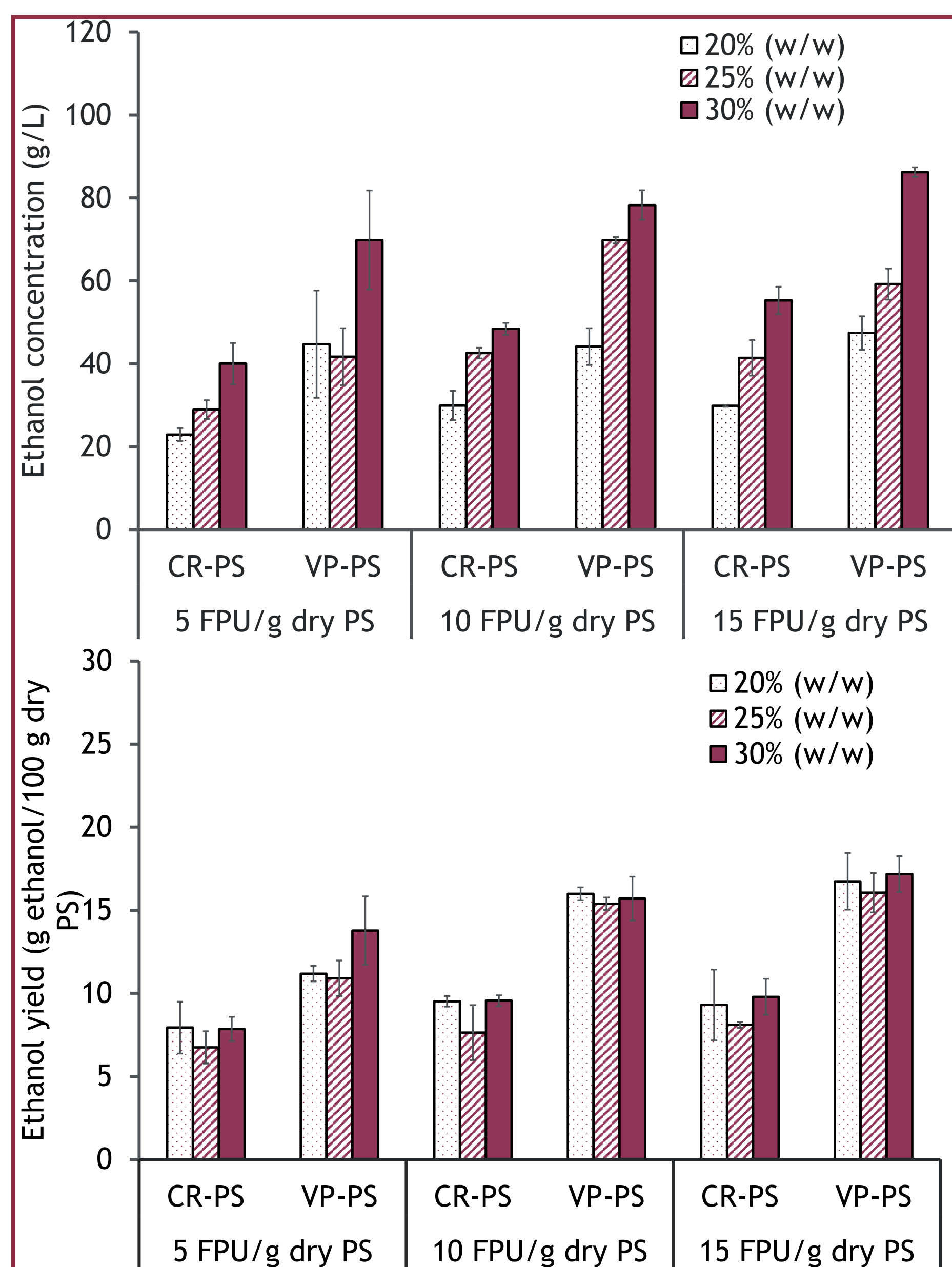


Fig. 1. Ethanol concentration and yield at different solids loadings and enzyme dosages using Ethanol Red®

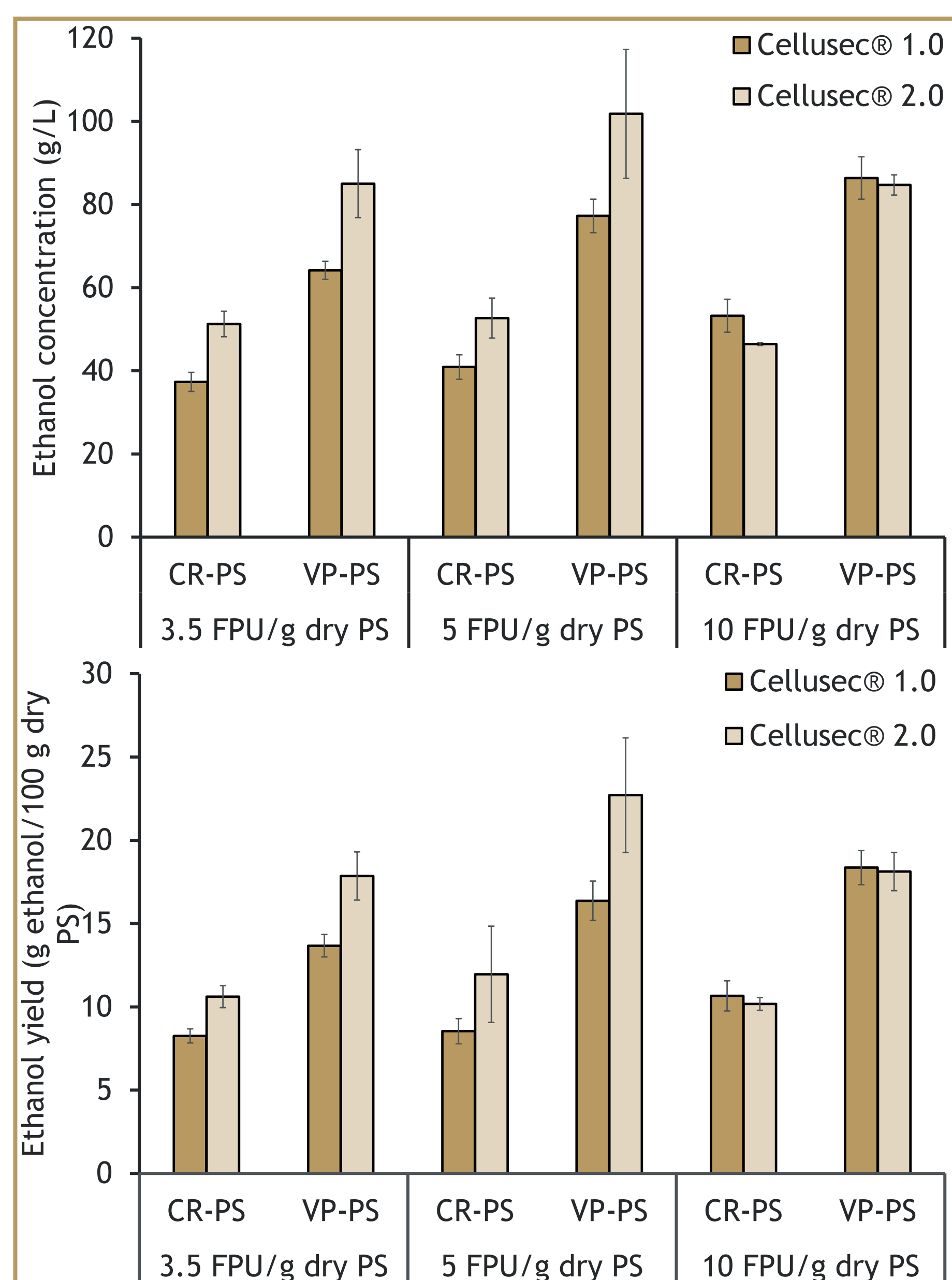


Fig. 2. Ethanol concentration and yield at 30% (w/w) solids loading using Cellusec® 1.0 and 2.0

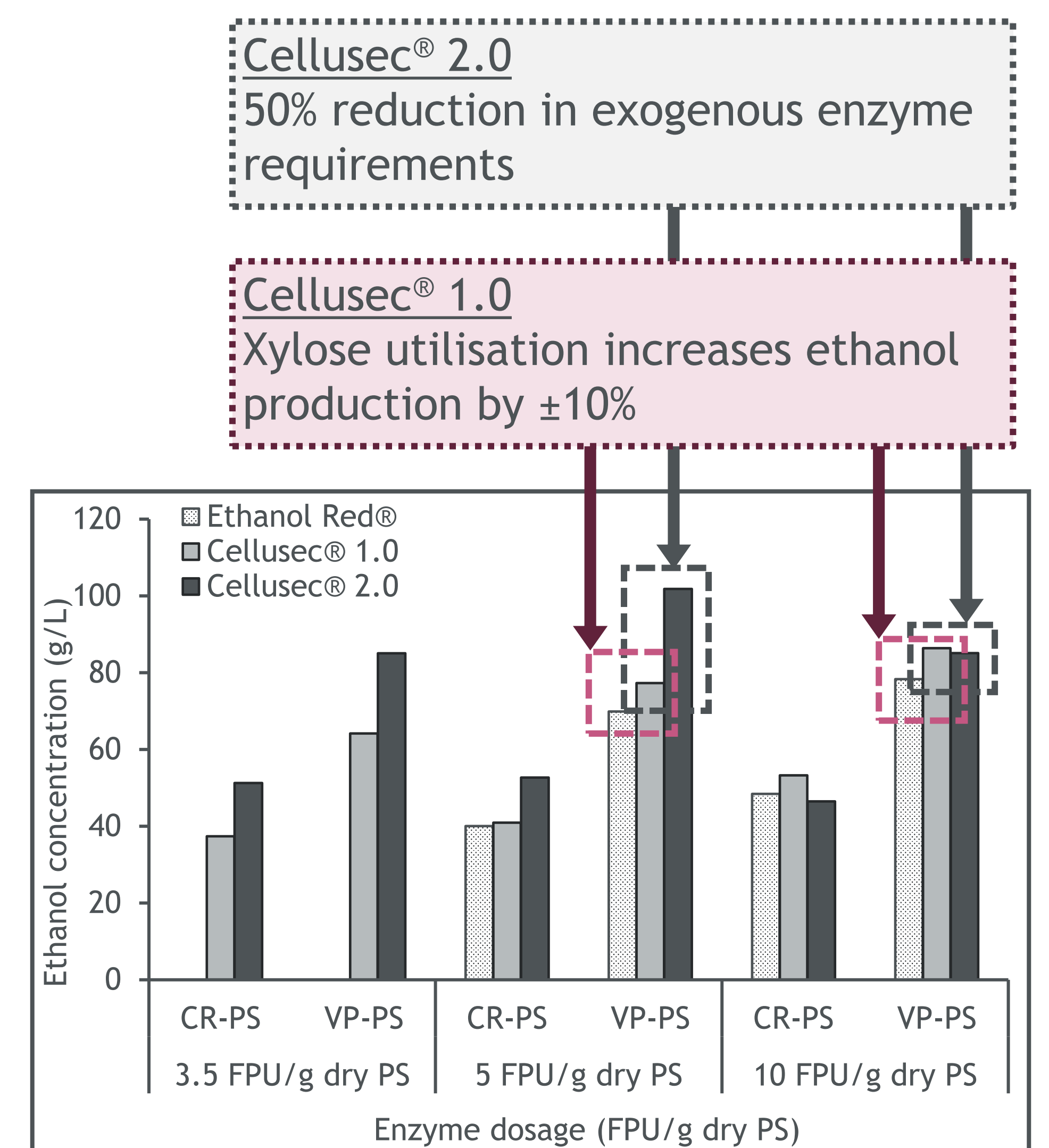


Fig. 3. Summary of fermentations at 30% (w/w) solids with 3 yeast strains

Conclusions

- High-solids PS waste fermentations resulted in ethanol concentrations double of what has previously been reported
- 2G fermentation results rival 1G fermentations
- Xylose utilisation by engineered Cellusec® 1.0 increased ethanol production by 10% compared to Ethanol Red®
- Cellulase secretion by CBP strain, Cellusec® 2.0, reduced exogenous cellulase requirements by 50%