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Potato Protein Concentrate: Enhancing Quality Through Sustainable Phenolic Reduction Method

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INTRODUCTION & AIM

- **Potato fruit juice** (PFJ), a by-product in industrial potato processing (Fig. 1), contains 30-41 wt% protein with high nutritional value.
- However, the quality and taste of the protein are negatively impacted by phenolics in the potato.
- This study aims to deploy a sustainable method using novel adsorption resins to bind phenolics in PFJ and improve potato protein poncentrate's quality.

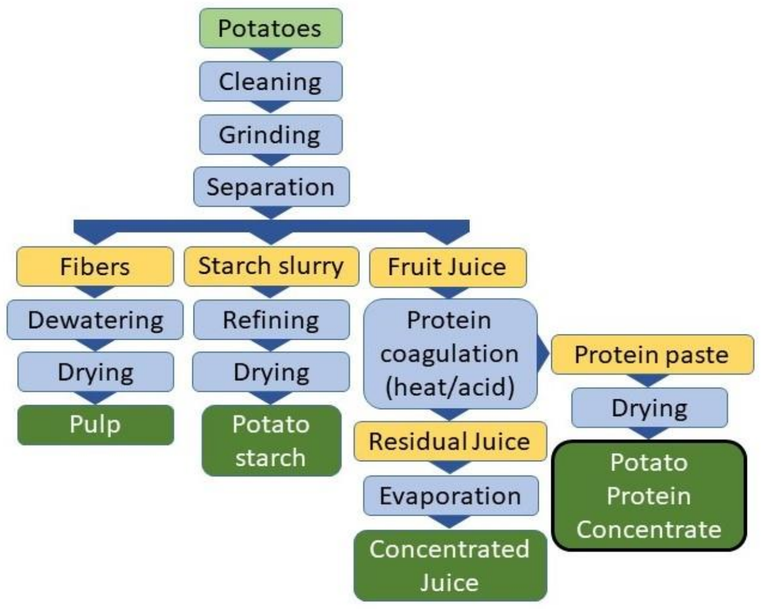

Fig 1. Processes in industrial potato starch production – showing how PPC is obtained from PFJ.

MATERIALS & METHOD

- Screened 20 novel adsorption resins (Strong Anion Exchange (SAX), Weak Anion Exchange (WAX), Reversed Phrase (RP), Weak Cation Exchange (WCX)) for phenolic binding capacity, using the ion exchange reaction (Fig 2).
- Determined resin capacity using Gallic Acid binding and HCl titration
- Tested selected resins for phenolic removal from PFJ
- Precipitated PPC using acid and heat before analyzing
- Quantified free and bound phenolics in recovered PPC

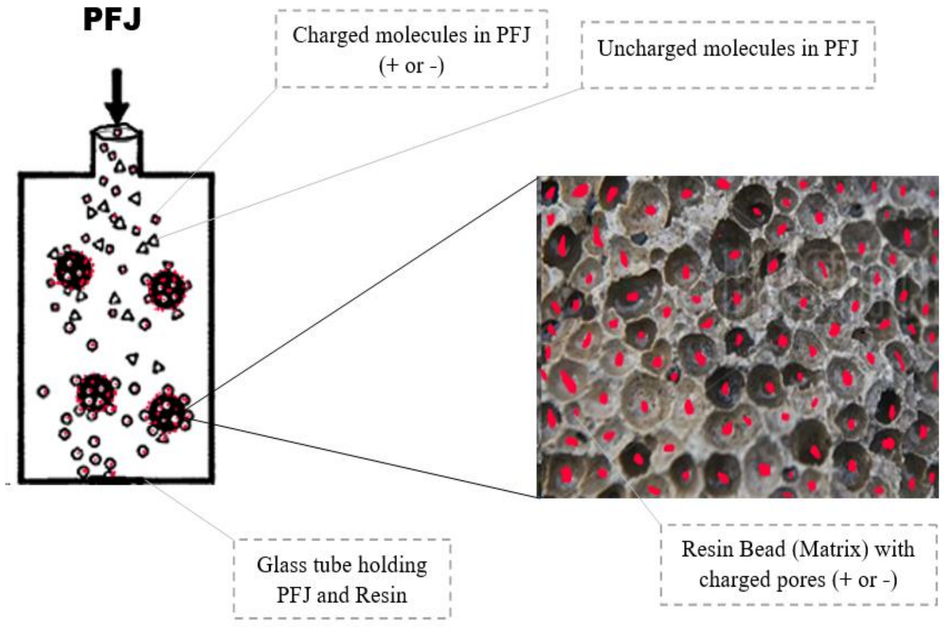

Fig. 2 Fundamentals of ion exchange reaction - showing charged and uncharged molecules in PFJ and the pores on a resin bead with functional groups that attract counterions.

RESULTS & DISCUSSION

- SAX resins most effectively reduced total phenolic content (TPC) in PFJ, overall (Fig. 3A).
- SAX 002 reduced PFJ TPC from 295 ± 0.63 µg/mL to 84 ± 0.12 µg/mL GAE, while WAX resins (e.g., WAX 007, 008) reduced TPC to 154 ± 0.31 µg/mL GAE (Fig. 3A).
- SAX 002 produced lowest residual phenolics in PPC (0.31 ± 0.19 µg/mg GAE), while WAX 003 achieved highest PPC yield (90.1 ± 0.12% of control) but with higher phenolic reduction (Fig. 3A&B).
- Trade-off observed between phenolic reduction and PPC yield.

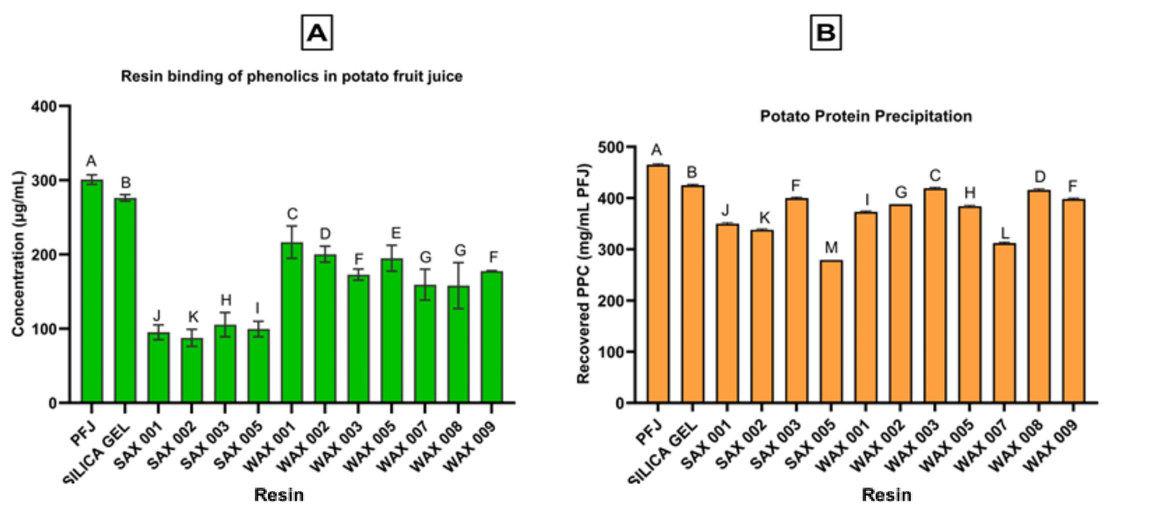

Fig 3. Resin binding of phenolics in PFJ and amount of PPC precipitated from from resin-treated PFJ

- Results for free and bound phenolics extractions showed the resin effect even after alkaline and acidic extractions (Fig 4).

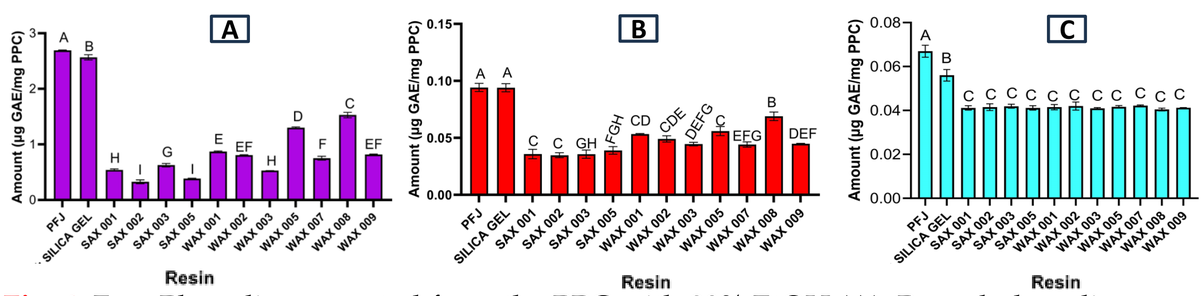

Fig. 4. Free Phenolics extracted from the PPC with 80% EtOH (A), Bound phenolics extracted from the PPC by the alkaline procedure (B), Bound phenolics extracted from the PPC by the acidic procedure (C).

CONCLUSION

- Novel adsorption resins effectively bind phenolics in PFJ and improve PPC quality.
- SAX resins outperform WAX resins in reducing TPC.
- SAX 002 treatment resulted in 180-fold reduction in TPC compared to untreated PPC.
- Trade-off exists between PPC purity and yield.
- Resin selection should balance phenolic reduction, protein yield, and specific application requirements.

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