The Effects of Pyrolysis on Upcycling Polyvinyl Chloride (PVC) Present in Gloves Through Reattaining Hydrochloric Acid (HCl) for Higher-Value Applications

Chen, Grace (School: Mentor High School)

During the pandemic, the surge in production and usage of single-use plastics known as personal protective equipment (PPE) include gloves, which are commonly manufactured with polyvinyl chloride (PVC). With exacerbated waste production yet inefficient approaches to combat PVC's challenges, this paper studies a PVC disposal alternative through upcycling its chlorine content using pyrolysis. Research questions are asked: Will PVC present glove pyrolysis lead to an acidic pH in the beaker, To what extent is there a correlation between temperature and the HCl concentration released, and To what extent does PVC present gloves flexibility affect the HCl concentration released? Experimental groups consisted of PVC present gloves: vinyl and PVC gloves. Control group consisted of polyethylene (PE) gloves, as PE structure is similar to PVC but lacks the chlorine content. Glove samples were pyrolyzed for 90 minutes using a simple pyrolysis setup with tubing to a beaker of water. The beaker pH, heat temperature, observations, and titration results were recorded into scatterplots to analyze data. Beaker titration after pyrolysis resulted in PVC gloves giving greater HCl concentrations than vinyl gloves, suggesting that glove plastic composition affects the HCl. Correlation coefficients between heat temperatures and beaker concentrations were -0.982 and 0.945 for the PVC present gloves, indicating a strong relation between the two variables. Beaker titration after pyrolysis resulted in PVC gloves having greater HCl concentrations than vinyl gloves, suggesting that glove flexibility affects the HCl concentration. The data collected infers that pyrolysis selectively upcycles HCl from certain gloves over others.

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