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Investigation of Arsenic Accumulation in Deep-frying Oil

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INTRODUCTION

- Deep-frying is a popularly used cooking method. However, transfer and accumulation of contaminants during deep-frying have not been well studied yet.
- Certain contaminants such as arsenic poses risk due to their stability under high temperatures and high toxicity at low levels of exposure.
- In this study, deep-frying experiments using rapeseed oil, a common deep-frying oil, to repeatedly deep-fry oyster, a common frying food with high arsenic content, were designed to mimic local food trade practice to see whether arsenic build-up would be significant.

METHODOLOGY

- Samples were collected at 0, 1, 2, 4, 8, 16, 24, 32, 48, 64 cycles.
- Samples were digested and analyzed for arsenic and lead content using ICP-MS.



Figure 1. Color change of the deep-frying oil as it progressively deteriorated.

ACCUMULATION OF ARSENIC

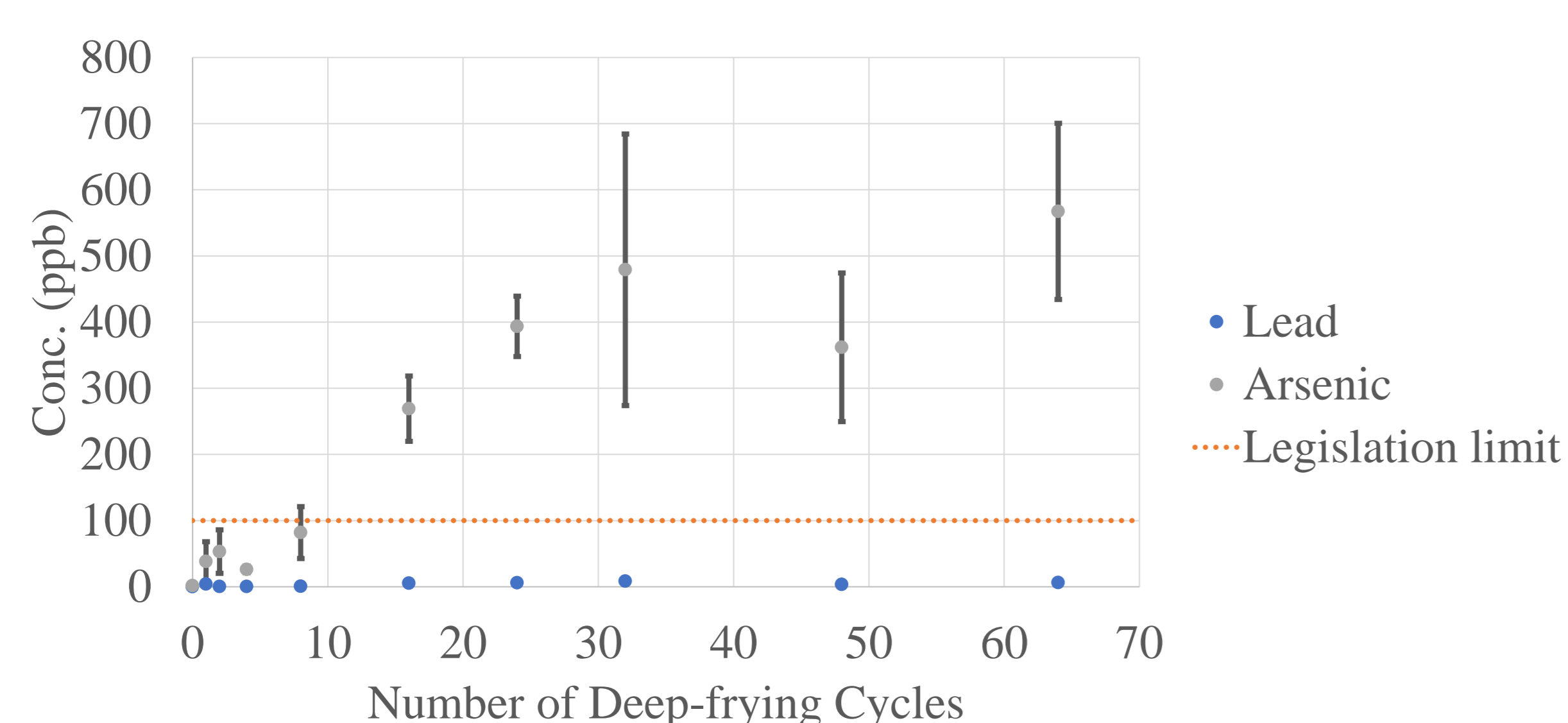


Figure 2. Arsenic and lead concentrations of unstrained deep-frying oil versus number of deep-frying cycles. The dotted line shows the legislation limit.

- Results demonstrated the accumulation of arsenic in deep-frying oil, which could be over 5 times higher than the legislation limit in Hong Kong.
- Significant fluctuations between replicates were observed.

SIGNIFICANCE OF RESIDUES FOUND IN OIL

- Residues in oil caused inhomogeneity in samples.

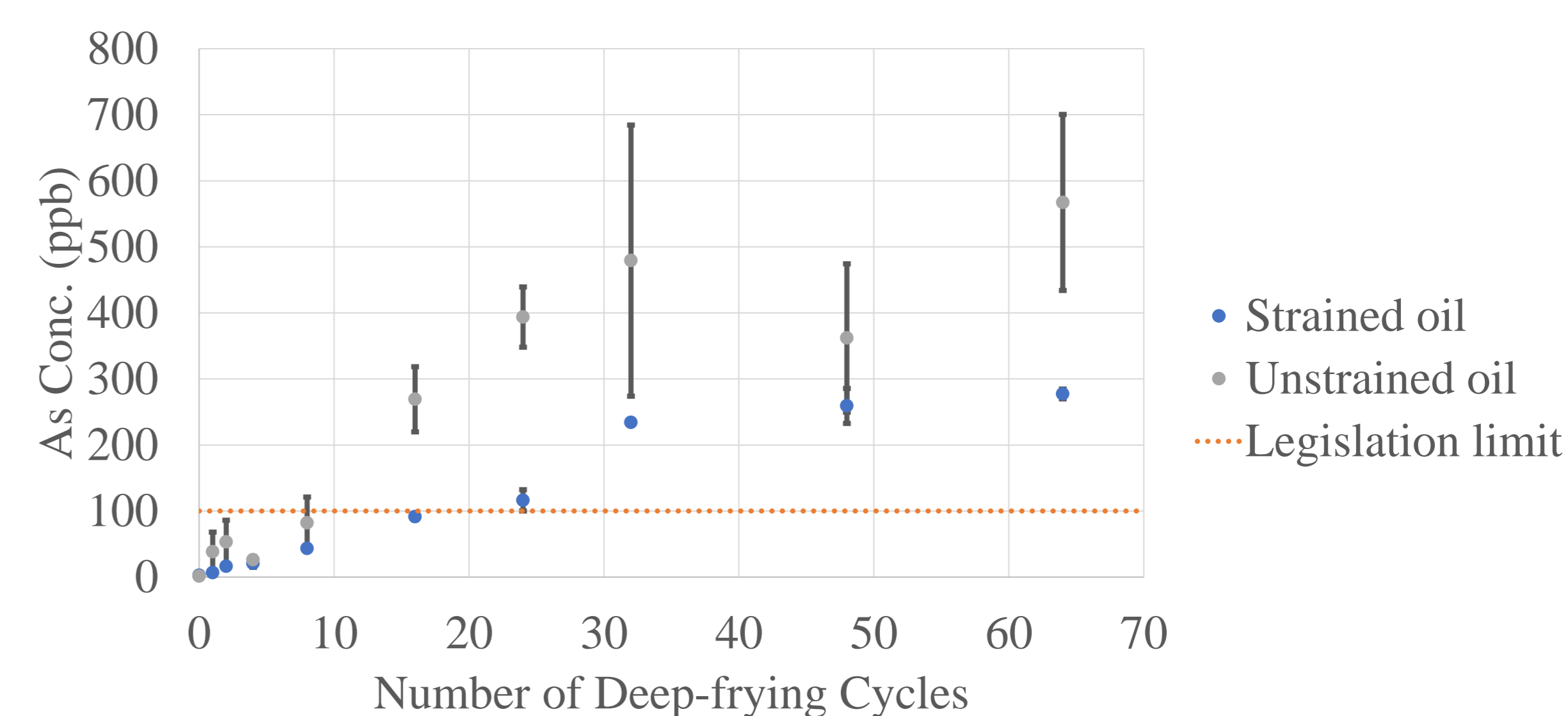


Figure 3. Comparison of arsenic concentrations of strained oil versus unstrained oil. Note that the arsenic concentrations of strained series were lower compared to the unstrained, and the standard deviations between sample replicates were significantly smaller in the strained series compared to the unstrained.

INVESTIGATION OF ACCUMULATION MECHANISM

- Arsenic concentrations of the residues were found to be over 100 times higher than those of the oil.
- The residues were likely formed from mass transferred from food to oil.



Figure 4. Residues formed during the deep-frying experiment (left) versus residues formed from deep-frying liquid collected when defrosting the oysters (right). The appearances and arsenic contents of the two were very similar.

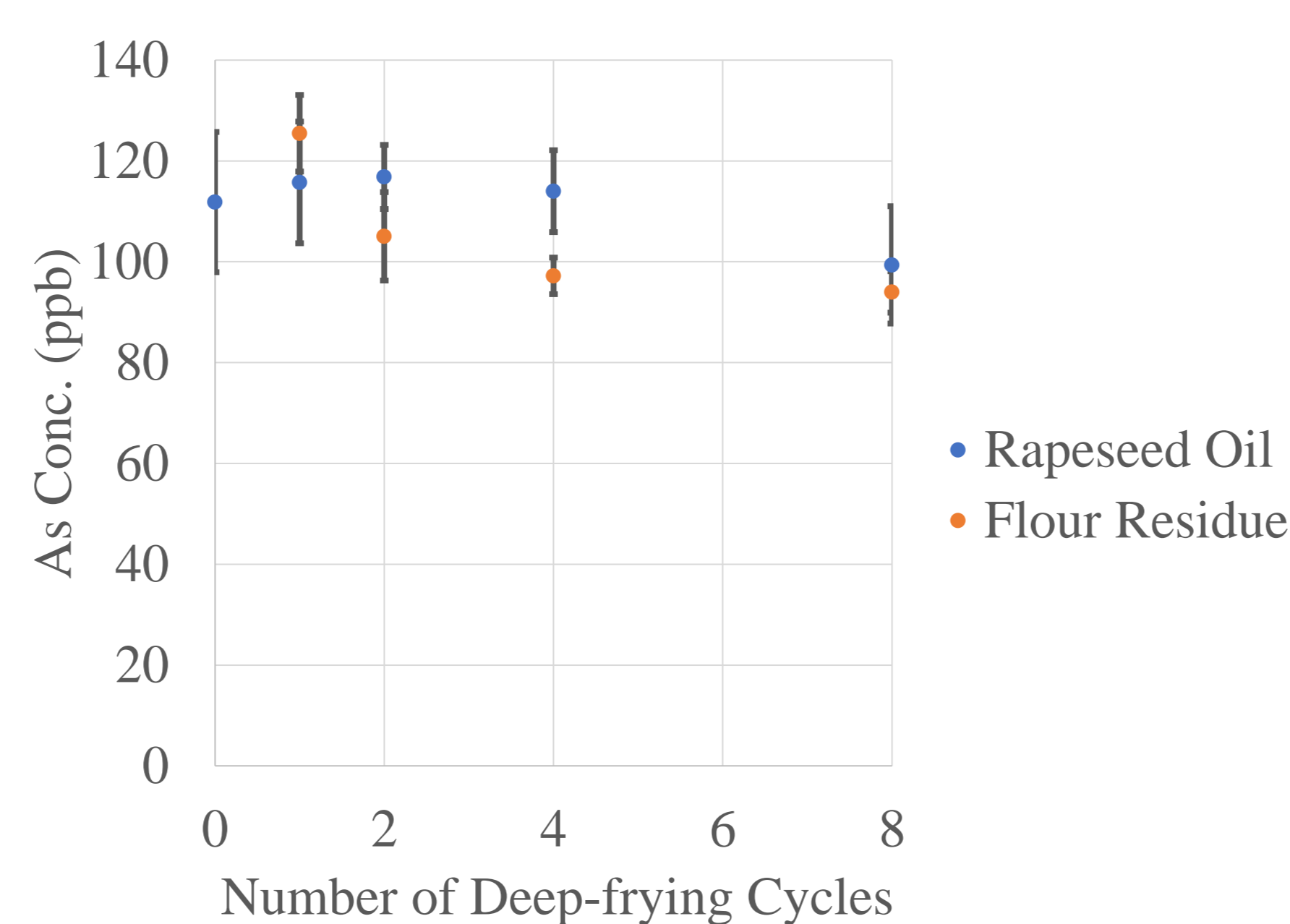


Figure 5. Adsorption of arsenic by flour mix to demonstrate whether arsenic is preferentially adsorbed onto residues.

- It is proposed that the arsenic in the liquid leached from oysters is concentrated and entrapped in the residues when the moisture is evaporated and residues are formed, causing high arsenic contents in residues and accumulation of arsenic in the frying oil.

CONCLUSIONS

- Accumulation of arsenic in deep-frying oil was observed during deep-frying of oyster.
- Arsenic concentrations of the strained residues, likely formed from liquid leached from oyster, were 100 times higher than that of deep-frying oil.
- Residues were likely originated from liquid leached from oysters.
- Further studies were needed to investigate the speciation of arsenic and evaluate possible food risks.

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