Avocado oil, coconut oil, walnut oil as true oil phase for ion transfer at nanoscale liquid/liquid interfaces

Text Transcript

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Hello, my name is Kerui, and I am from Dr. Mei Shen's group of electrochemistry. Today, I will be presenting my senior thesis project: Avocado oil, coconut oil, walnut oil as true oil phase for ion transfer at nanoscale liquid/liquid interfaces.

You might get intimidated by the title, but I promise to explain it very clearly. The main concept we are looking at all start from a term called ITIES. It means an interface between two immiscible electrolyte solutions. That is, the layer formed between two liquids that do not dissolve each other (in particular, we call them organic phase and aqueous phase). For instance, water and oil do not dissolve together, just like Donald Trump and Joe Biden doesn't, either. The boundary between them is where the ion transfer happens. Enable to detect these nanoscale transfers, and we employed another technique called nanopipette. How nano is it? It has a diameter of around 80nm, which is about 1000 times smaller than the diameter of a human hair. Once connect the nanopipettes using the cyclic voltammetry, we are able to detect the current changes in ion transfer.

As I mentioned before, typically, there are two solutions involved, here we use edible oils (avocado, coconut, and walnut oil) as organic phase and artificial seawater as the aqueous phase. The whole experiment divides into two steps: measuring and calculating. First, we measured the potential window for each edible oil. The potential window here indicates the flat plateau in between the tails. Different solvents have different window ranges. The red curve shows the background of ASW, and the black curve shows the detection of TBA. We also compared the

curves to DCE filled nanopipettes to confirm their uniqueness. The second step is to calculate the rate constant based on the Nernst equation. That determines how slow or how fast the ion transfer goes.

Furthermore, we discussed the possible conditions that might affect the results we got. For the difference in shapes of CV curves, we suspected that different compositions of the oils might play a huge role here. Where coconut oil contains mostly saturated fatty acids, avocado, and walnut oils contains more unsaturated fatty acids. In the transfer kinetics results, we supposed that the difference in transfer coefficients might came from different viscosity. The less viscous the solution is, the larger the transfer coefficient will be.

In summary, we defined a distinctive potential window and kinetics for each edible oil. We also proved that edible oil could work as an organic phase in ITIES detections. This experiment will lay a foundation of researches in edible oil applications in nanoelectrochemistry.