

# Spontaneous emulsification and self-propulsion of oil droplets induced by the synthesis of amino acid-based surfactants: Electrical Supplementary Information

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## I. MASS SPECTROMETRY

Here we show that all the compounds, **1–10**, introduced in the text were actually detected by the mass spectrometry. Figure S1 shows the mass spectrum of octanal before reaction [the same data as the one shown in Fig. 5(a) in the main text], where octanal molecules (the compound **2**) were detected. Figures S3–S4 show, respectively, the mass spectra of the emulsion phase, the octanal phase, and the histidine aqueous phase. These figures use the same data as those shown in Fig. 6 in the main text. The compounds **3–10** are detected in all the spectra.

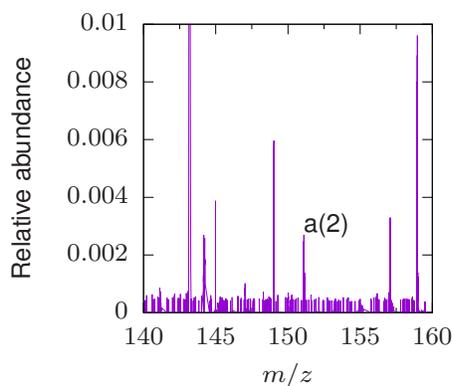


FIG. S1. A mass spectrum of octanal showing the peak “a” (Compound **2**) at  $m/z = 151.11$ , the molecular mass of an octanal molecule plus a sodium ion.

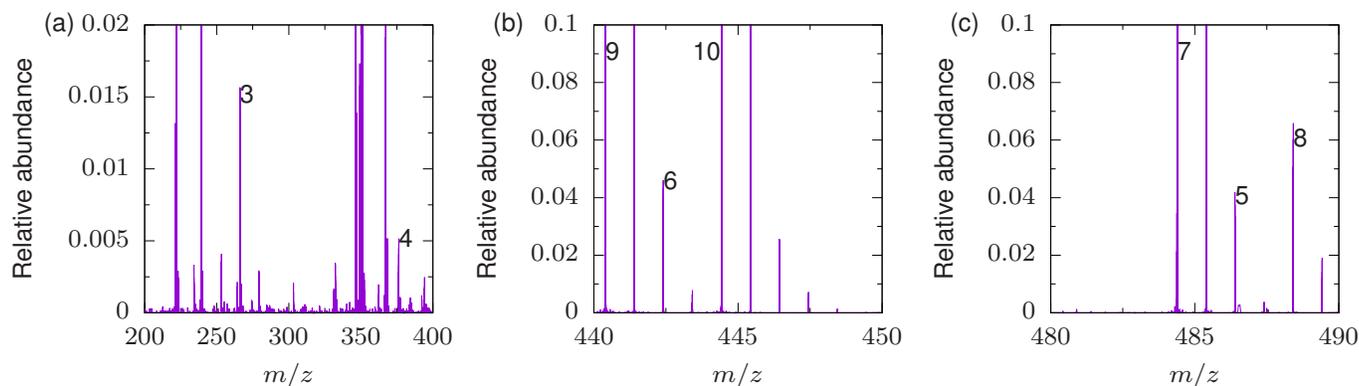


FIG. S2. Enlarged mass spectra of the emulsion phase [Fig. 6(a) and (b) in the main text] after the reaction.

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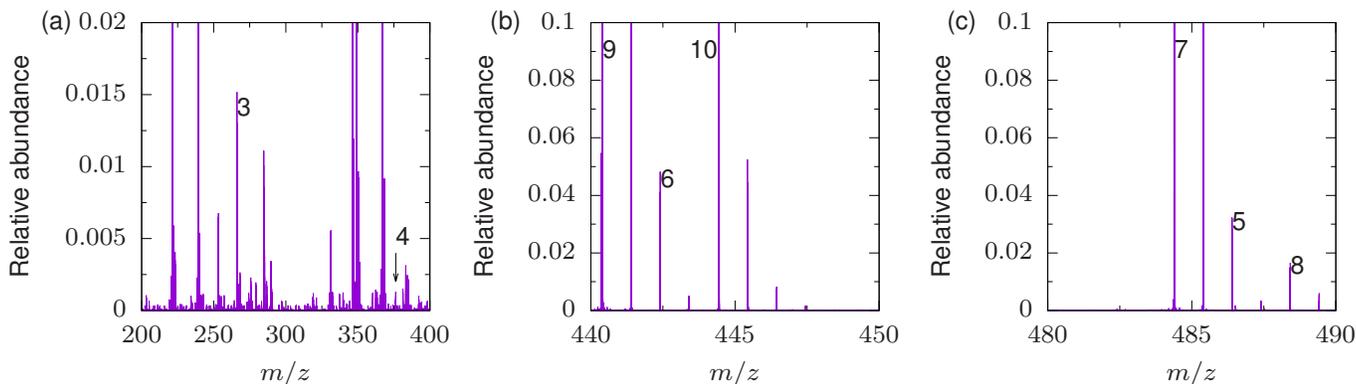


FIG. S3. Enlarged mass spectra of the octanal phase [Fig. 6(c) in the main text] after the reaction.

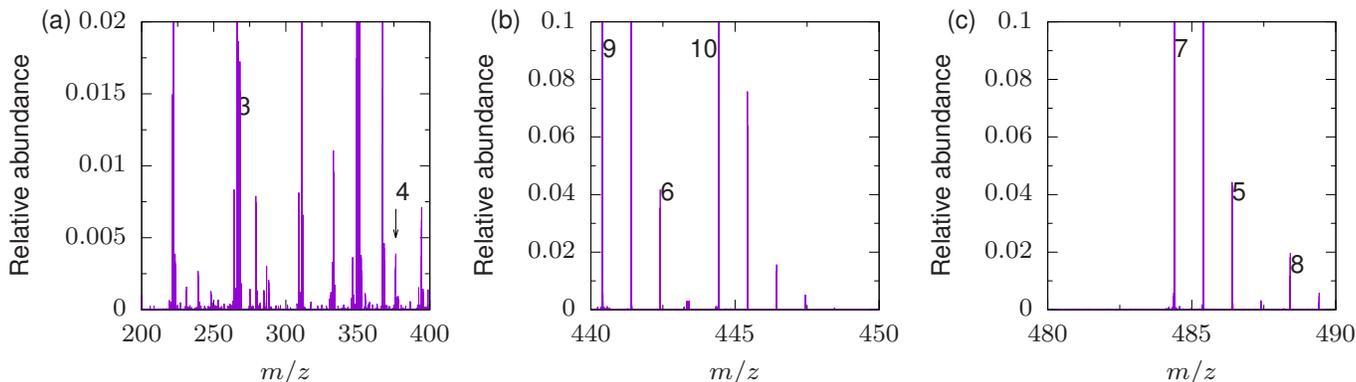


FIG. S4. Enlarged mass spectra of the histidine aqueous phase [Fig. 6(d) in the main text] after the reaction.

## II. SELF-PROPULSION

**mov-1** A movie of a droplet's self-propulsion. The droplet was placed on water equilibrated with octanal at one end of the channel. Histidine powder was added at another end. As histidine dissolved, the droplet started moving. The speed of the movie is accelerated 100 times.

**mov-2** A movie showing no self-propulsion, when the droplet contained same surfactant but prepared and mixed in advance. No histidine was added. The speed of the movie is accelerated 10 times.

**mov-3** A movie showing self-propulsion in a homogeneous solution of histidine and SDS. Small amount of SDS (0.7 mM) was added initially to keep the droplet from splitting when it was placed on the surface. The concentration of histidine was 0.19 M. When no histidine was added, no propulsion was observed. The speed of the movie is accelerated 100 times.

**Figure S5** The characteristic self-propulsion of the droplet shown in mov-3. The area and the speed exhibit clear oscillation and synchronization in this homogeneous condition. This shows the self-propulsion of the droplet without any externally given gradient.

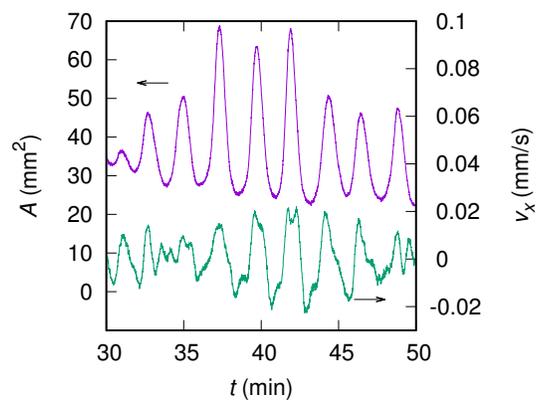


FIG. S5. The speed and area of the droplet in mov-3.avi.