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Supplementary Information
Dynamics of spreading of an asymmetrically placed droplet near a fluid-fluid interface

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1 Effect of interfacial width

Simulations are also performed to study the effects of interfacial width on the dynamics of the asymmetrically placed droplet. The temporal evolution of the centre of mass and scaled contact line radius for the cases $a(=b) = 0.75, 1.5, 2$ for $w = 0.45$, $w = 1$ and $w = 2$ when the drop is placed at $d = 15$ are shown respectively in the fig. 1 (a) and (b). The solid lines represent the data corresponding to $w = 0.45$, whereas the dashed and dotted lines correspond to $w = 1$ and $w = 2$, respectively. As reported in sec. 4.2 in the manuscript, the values of a and b do not significantly affect the temporal evolution of $Y_{12} - Y_{CM}(t)$. However, the increase in the interfacial width results in faster vertical migration of the droplet, allowing the droplet to assume the equilibrium state faster, as shown in fig.1(a).

As shown in fig. 1(b), a marginal reduction in the equilibrium radius is observed as the interfacial width increases. This is because the higher the interfacial width, the lesser the mass available for the adsorption-spreading process. However, the equilibrium radius of the droplet still depends on the values of $a(=b)$ in accordance with the discussion in sec. 4.2. These results illustrate that choosing a larger interfacial width, which resolves the interface more accurately, does not change the overall dynamics of the spreading-dissolution process.

2 Effect of viscosity

Further, to study the effect of viscosity, simulations are performed at two more values of viscosities, $\mu = 0.33$ and 0.5. The figures 2(a) and (b) show the temporal evolution of the centre of mass and contact-line radius for $a(=b) = 0.75, 1.5, 2$ when the droplet is placed at $d = 15$ for all three values of viscosity. There is no considerable change in the temporal evolution of the centre of mass or the contact-line radius with increased viscosity in the limited range investigated. However, the values of $a(=b)$ affect both parameters, albeit minor. These results illustrate that for a particular value of $a(=b)$, the droplet takes more time to reach equilibrium when the viscosity increases.

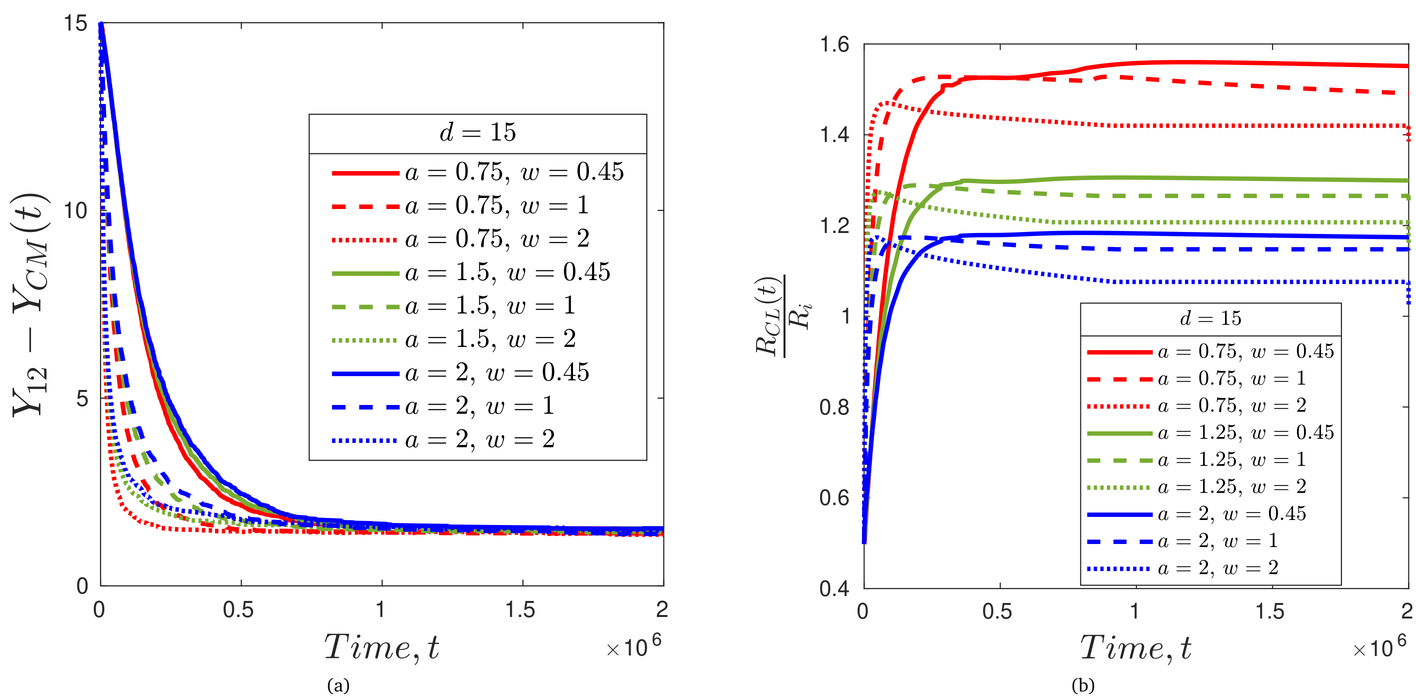

Figure 1: The temporal evolution of (a) the centre of mass (b) the contact-line radius for cases $a(=b) = 0.75, 1.5, 2$ when the droplet is placed at $d = 15$ for various choices of interfacial width, namely $w = 0.45, 1$ and 2.

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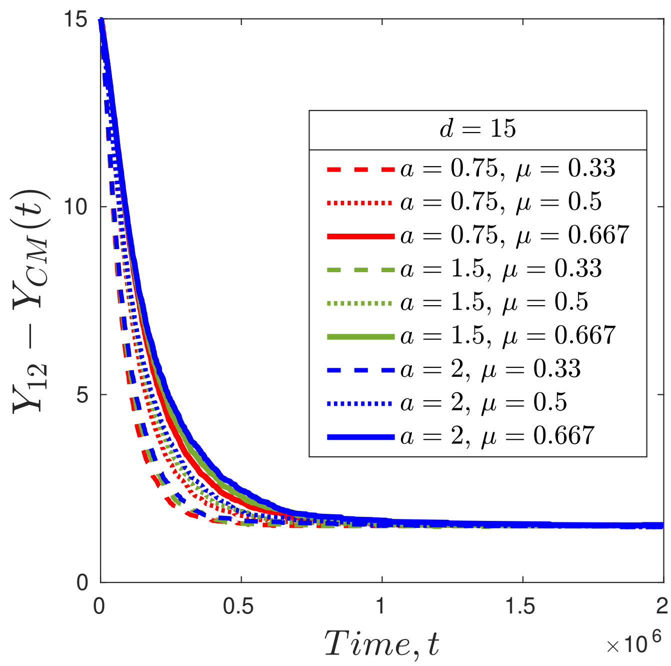
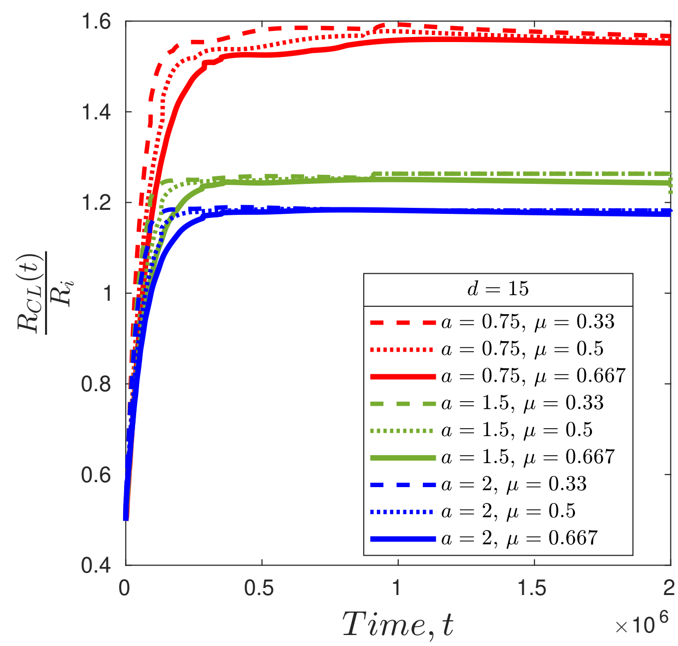


(a)



(b)

Figure 2: The temporal evolution of (a) the centre of mass (b) contact-line radius for cases $a(= b) = 0.75, 1.5, 2$ when the droplet is placed at $d = 15$ for three different values of fluid viscosity, $\mu = 0.33, 0.5, 0.667$. Note that all three phases have the same viscosity in the simulations.