

Nine Tenths of What You Add Never Reaches the Interface

— Above the critical micelle concentration of **0.008** mol/L the surface tension does not move from **0.030000** N/m — add ten times as much and only **0.100000000000** of it acts at the interface — yet solubilisation keeps rising with the micelles. One act of “adding more” feeding two different quantities — [Paper 475]

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— *From thinking to syncing.* —

Abstract

Detergent is thought to work better the more concentrated it is. This paper shows that one act of “adding more” splits into a quantity that saturates and one that keeps rising—the surface tension stops at **0.030000** N/m while the micelles grow linearly. No new theorem or law is claimed. First, at the critical micelle concentration of 0.008 mol/L the tension reaches exactly **0.030000000000** N/m (Section 2). Second, ten times that concentration leaves the tension exactly unmoved (Section 2). Third, this is the core of the paper. At ten times, only **0.100000000000** of what was added acts at the interface (Section 3). Fourth, the acting fraction is inverse in concentration, and the product is exactly conserved (Section 3). Fifth, but the micelles grow linearly above the critical concentration, exactly 0.060 between 0.020 and 0.080 (Section 3). Sixth, the separator is whether the action is at an interface or inside a volume (Section 4). **Keywords:** surfactant, critical micelle concentration, micelle, surface tension, detergent.

Scope of this paper (scope note): No new theorem or law is claimed—the critical micelle concentration, the lowering of surface tension by surfactants and solubilisation by micelles are all standard. No detergent is designed—formulation, enzymes, builders and foaming are not the subject. A piecewise-linear form is used—monomer concentration is taken to saturate sharply at the critical value; the real curve is smooth and the transition has width. Cleaning mechanisms are excluded—wetting, emulsification, anti-redeposition and mechanical action are not the subject. Temperature and salt are excluded—the critical concentration moves with both; one value is fixed here. Relation to earlier papers: Paper 474 showed that what carries distant sound is the temperature aloft and not the quiet—there too, two accounts were mixed into one phenomenon. Paper 300 showed that common root and distinct root can be decided—“surface activity” and “solubilisation” are distinct roots by that criterion. Paper 452 showed that what lifts is a difference in surface tension—there too, one term for surface tension carried two roles. What is added is tabulating monomer concentration and tension at five concentrations, showing the exact arrival at the minimum, giving the acting fraction as 0.100000000000, confirming that the product is exactly conserved, showing the linear growth of micelles, and placing the separator at interface versus volume.

1. Notation and the Question

Setting: Let the total surfactant concentration be c and the critical micelle concentration c_{cmc} . The dissolved monomer concentration saturates,

$$m(c) = \min(c, c_{\text{cmc}})$$

and the excess forms micelles,

$$M(c) = \max(0, c - c_{\text{cmc}})$$

Take the surface tension to fall in proportion to the monomer concentration,

$$\sigma(c) = \sigma_0 - (\sigma_0 - \sigma_{\text{min}}) \frac{m(c)}{c_{\text{cmc}}}$$

Below, $c_{\text{cmc}} = 0.008 \text{ mol/L}$, $\sigma_0 = 0.0728$ and $\sigma_{\text{min}} = 0.030 \text{ N/m}$.

Observation 1.1

Detergent is thought to work better the more concentrated it is. Add more and it is stronger—treated as a question of quantity.

Observation 1.2

But an interface has only so much room. Once the surface is covered, no more can go on—so where does the excess go.

Question: Is the excess doing nothing.

2. Above the Critical Concentration the Tension Is Exactly Unmoved

Computation 2.1: Take the monomer concentration and the surface tension at five concentrations.

Total [mol/L]	Monomer [mol/L]	Surface tension [N/m]
0.001	0.001000	0.067450
0.004	0.004000	0.051400
0.008	0.008000	0.030000
0.020	0.008000	0.030000
0.080	0.008000	0.030000

Observation 2.2

At the critical concentration it reaches exactly **0.030000000000** N/m. The assumed minimum—where the interface saturates.

Observation 2.3

Ten times as much leaves it exactly unmoved. The difference between 0.008 and 0.080 is **0.0000000000000000**—not approximately, but identically zero in this model.

Observation 2.4

Below the critical concentration it falls linearly. The drop from 0.002 to 0.004 exactly equals that from 0.004 to 0.006—the left half is a straight line.

Observation 2.5

So “add more” loses its meaning at the critical concentration. It acts below and not above—a sharp boundary.

3. A Tenth Acts, and the Rest Is Working Too

Computation 3.1: Take the fraction of what was added that acts at the interface.

Total [mol/L]	Acting fraction	Micelles [mol/L]
0.008	1.000000	0.000
0.020	0.400000	0.012
0.080	0.100000	0.072

Observation 3.2

At the critical concentration all of it acts. 1.0000000000000000—not one molecule to spare.

Observation 3.3

At ten times, only 0.100000000000 acts. Nine tenths never reach the interface—waste, if surface tension is the aim.

Observation 3.4

The acting fraction is inverse in concentration. Fraction times concentration is exactly 0.008 at every concentration—because the monomer concentration saturates.

Observation 3.5

But the excess is forming micelles. 0.012 at 0.020 and 0.072 at 0.080—growing linearly above the critical concentration.

Observation 3.6

The increment exactly equals the increment in concentration. The 0.060 between 0.080 and 0.020 appears whole in the micelles—everything above the threshold becomes micelle.

Observation 3.7

And micelles take oily soil inside. Solubilisation is proportional to micelle content—so “more is wasted” is right about the interface and wrong about cleaning.

4. The Separator

The separator: is the action at an interface, or inside a volume.

Observation 4.1

At an interface, the room is finite and it saturates. The surface area sets the ceiling—and it stops at the critical concentration.

Observation 4.2

Inside a volume, more containers simply mean more capacity. Nothing caps the number of micelles—it goes on rising linearly.

Observation 4.3

These are distinct roots by the criterion of Paper 300. Both are called “how well the detergent works”—one a quantity of interface, one of volume.

Observation 4.4

This stands where Paper 452 stands. There, one term for surface tension carried both a value and a difference of values—here one term for surfactant carries both an interface and an interior.

Observation 4.5

It overlaps Paper 474 as well. There, two accounts were mixed into one night—here a saturating quantity and a linear one are mixed into one act of adding.

Observation 4.6

So when saying “more is pointless”, state the aim. Pointless for foam and wetting, useful for solubilising oil—one operation with two answers.

Observation 4.7

To be honest—a piecewise-linear form was used. Real monomer concentration turns over smoothly and the transition has width—the exactness of 0.100000000000 belongs to the model; that a saturating quantity and a linear one live together does not.

5. Roll Call and Closing

1. **0.030000000000 N/m at the critical value (Observation 2.2): the interface saturates.**
2. **Ten times leaves it exactly unmoved (Observation 2.3): a difference of zero.**
3. **Linear below (Observation 2.4): the left half is a line.**
4. **All of it acts at the critical value (Observation 3.2): 1.0000000000000000.**
5. **0.100000000000 at ten times (Computation 3.1): the core.**
6. **Fraction times concentration conserved (Observation 3.4): monomer saturates.**
7. **Micelles grow linearly (Observation 3.5): 0.012 and 0.072.**
8. **The increment matches exactly (Observation 3.6): the excess becomes micelle.**
9. **The separator is interface or volume (Observation 4.3): distinct roots by Paper 300.**
10. **State the aim and the answer follows (Observation 4.6): one operation, two answers.**

Closing: Detergent is thought to work better the more concentrated it is—add more and it is stronger, treated as a question of quantity. But an interface has only so much room: once the surface is covered, no more can go on. So where does the excess go. The interface side saturates sharply—at the critical micelle concentration of 0.008 mol/L the tension reaches exactly **0.030000000000 N/m**, where the interface saturates. Ten times as much, at 0.080, leaves the tension changed by **0.0000000000000000**: not approximately, but identically zero in this model. Below the critical concentration it falls linearly, the drop from 0.002 to 0.004 exactly equalling that from 0.004 to 0.006. So “add more” loses its meaning at the critical concentration—acting below and not above. A tenth acts, and the rest is working too—at the critical concentration the acting fraction is **1.0000000000000000**, not one molecule to spare; at ten times it is **0.100000000000** and nine tenths never reach the interface. The acting fraction is inverse in concentration, with fraction times concentration exactly 0.008 everywhere, because the monomer concentration saturates. But the excess is forming micelles: 0.012 at 0.020 and 0.072 at 0.080, growing linearly above the threshold. The increment exactly equals the increment in concentration—the 0.060 between 0.080 and 0.020 appears whole in the micelles. And micelles take oily soil inside, with solubilisation proportional to micelle content. So “more is wasted” is right about the interface and wrong about cleaning. One thing separates them—is the action at an interface, or inside a volume. At an interface the room is finite, the surface area sets the ceiling, and it stops at the critical concentration. Inside a volume more containers mean more capacity, nothing caps the number of micelles, and it rises linearly. They are distinct roots by the criterion of Paper 300, one a quantity of interface and one of volume. This stands where Paper 452 stands, where one term for surface tension carried both a value and a difference: here one term for surfactant carries both an interface and an interior. It overlaps Paper 474 too, where two accounts were mixed into one night: here a saturating quantity and a linear one are mixed into one act of adding. So when saying “more is pointless”, state the aim—pointless for foam and wetting, useful for solubilising oil. One operation with two answers. To be honest—a piecewise-linear form was used, and real monomer concentration

turns over smoothly with a transition of some width. The exactness of 0.100000000000 belongs to the model; that a saturating quantity and a linear one live together does not.

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