Supramolecular Chemistry-I

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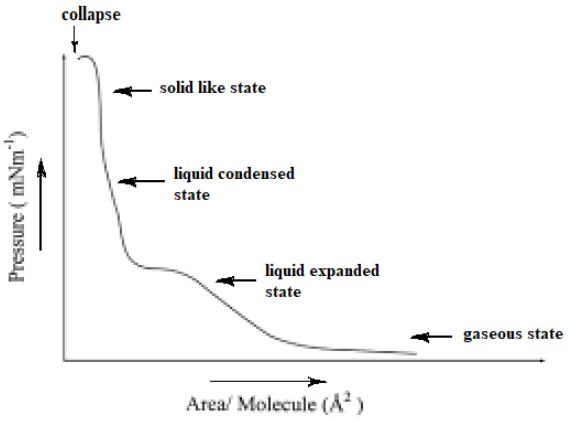
Week - 08

Lecture – 40

Good morning, welcome back and today will be my last class of this course. So I was doing this how amphiphiles behave at air water interface ok and I was telling that when I put the amphiphile at the water-air interface, they are far apart in the beginning. So, it is gas like and it is a 2D gas. Now when I move my barrier towards the fixed barrier. What will happen then? These amphiphiles come closer and so the headgroups will come closer to each other and they will experience a repulsive force. And this particular state is like a 2D pressure also known as the surface pressure. This is called the surface pressure. So, we plot area per molecule in $Å^2$ as the X-axis and surface pressure in milli Newton per meter (mNm^{-1}). And since the temperature is constant, it is called Pressure Area Isotherm or Langmuir Isotherm. This is reproduced again here:

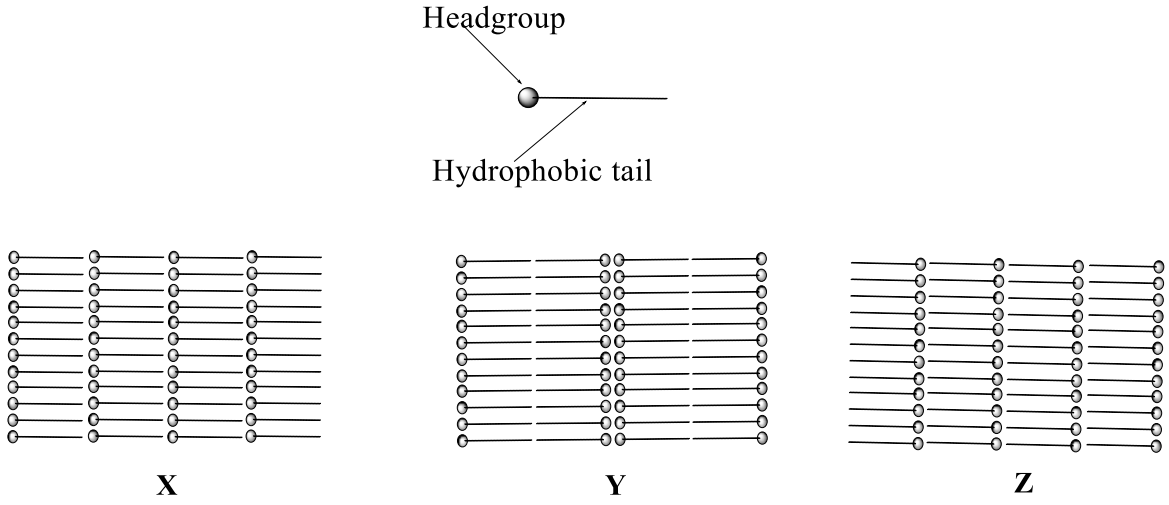


Now before we take out this whole monolayer of the amplifiers we have to know how stable it is. To find out the stability of monolayer we plot A_t/A_o vs. time. Here, A_t stands for area of the monolayer area at time t, and A_0 is similarly area of the monolayer at t=0. If the plot is almost parallel to the time axis, the monolayer is stable. You should understand how do we get to measure A_t. At time t, if A_t is lower than A_0 then the surface pressure will go down. In that case, we move the moveable barrier towards the fixed barrier to reduce the area to make the pressure as in case of A_0. The area at this time will

then be equal to A_t. Now how it looks like if it is unstable? The ration A_t/A_0 will be initially 1 but soon it will go down when the pressure is constant.

So, when the amphiphile makes a stable monolayer and the solid like state means the headgroups are touching one another. At this stage, we want to take this monolayer out in a suitable substrate. We can transfer onto a substrate simply by dipping it into the water and bring it up when the monolayers will attach on the surface of the substrate. A substrate can be a clean quartz plate, a simple glass plate coated with indium tin oxide (ITO coated glass) or a quartz plate coated with an organic compound to make it somewhat hydrophobic while the previous two will be hydrophilic.

If my substrate surface is hydrophilic, then the headgroups will attach to the surface and the tails will be up in air while the substrate goes down slowly and monitored by a computer. Then I can put it down and then while I am taking it up everything by a computer at a predetermined rate very slowly the amphiphiles will attach to the substrate. At this point we let it dry up a bit. Besides, the concentration of amphiphilic molecules in the trough will be lower and so must be replenished with new batch and come to the point where the headgroups touch each other as before. Then the substrate with one layer attached should be downed and a second layer of amphiphilic molecules gets deposited. This way 50-100 layers can be deposited onto the substrate. Three types of films are possible:



Thank you very much and good luck. This is the part I of Supramolecular Chemistry I wanted to give you.