Contra Costa College

PESTICIDE PARTITIONING WITHIN A SURFACTANT-AIDED SOIL WASHING SYSTEM

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INSET
Internships in Nanosystems Science, Engineering and Technology

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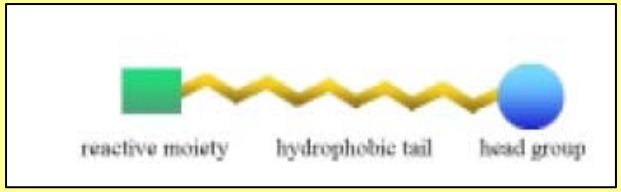
UCSB

BACKGROUND

- Pesticide Contamination
- Surfactants

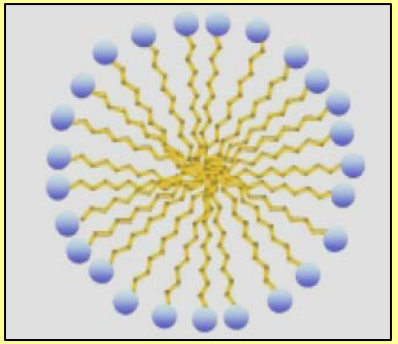
  Surfactants in water/soil system is present as:

  - Monomers;
  - Micelles, which are aggregates of the monomers and form when the monomer concentration reaches the Critical Micelle Concentration (CMC) value;
  - Sorbed surfactants in the soil particles



Monomer

Monomer Conc. = CMC



Micelle

OBJECTIVE

- To investigate pesticide partitioning behavior within a surfactant-aided soil washing system.

WHAT WE DID…

- Study the sorption behaviors of pesticides and surfactants onto soil particles;
- Study the pesticide sorption in the presence of surfactants;
- Investigate the effect of surfactants on desorption of pesticides.

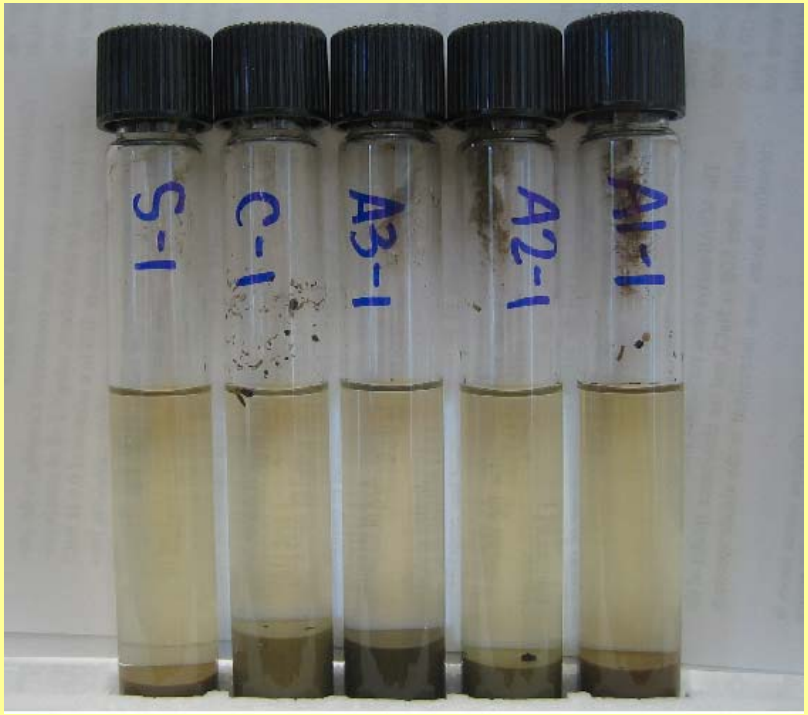
MATERIALS

- Soil Samples
  - Agriculture (Ag)#1, Ag#2, Ag#3
  - Clayey
  - Sediment
- Pesticides
  - Atrazine
  - Diuron
- Surfactants
  - Triton (Nonionic)
  - Linear Alkyl Sulfate (LAS)
  - Sodium Dodecyl Sulfate (SDS) (Anionic)
  - Benzalkonium Chloride (BC) (Cationic)

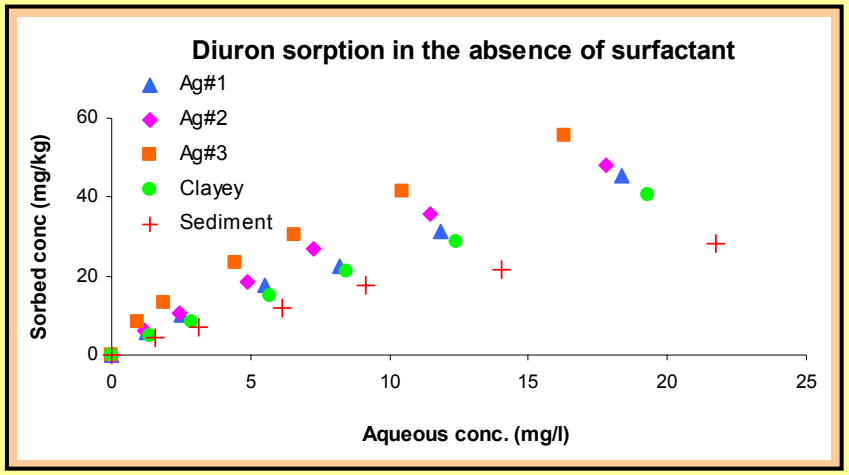
METHOD

- Batch Equilibrium Technique was used to conduct all sorption and desorption experiment.

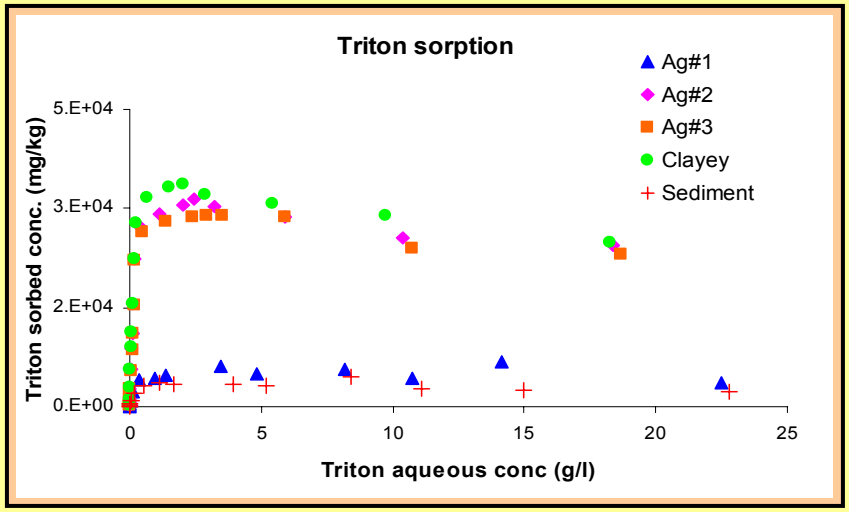
High Performance Liquid Chromatography (HPLC)



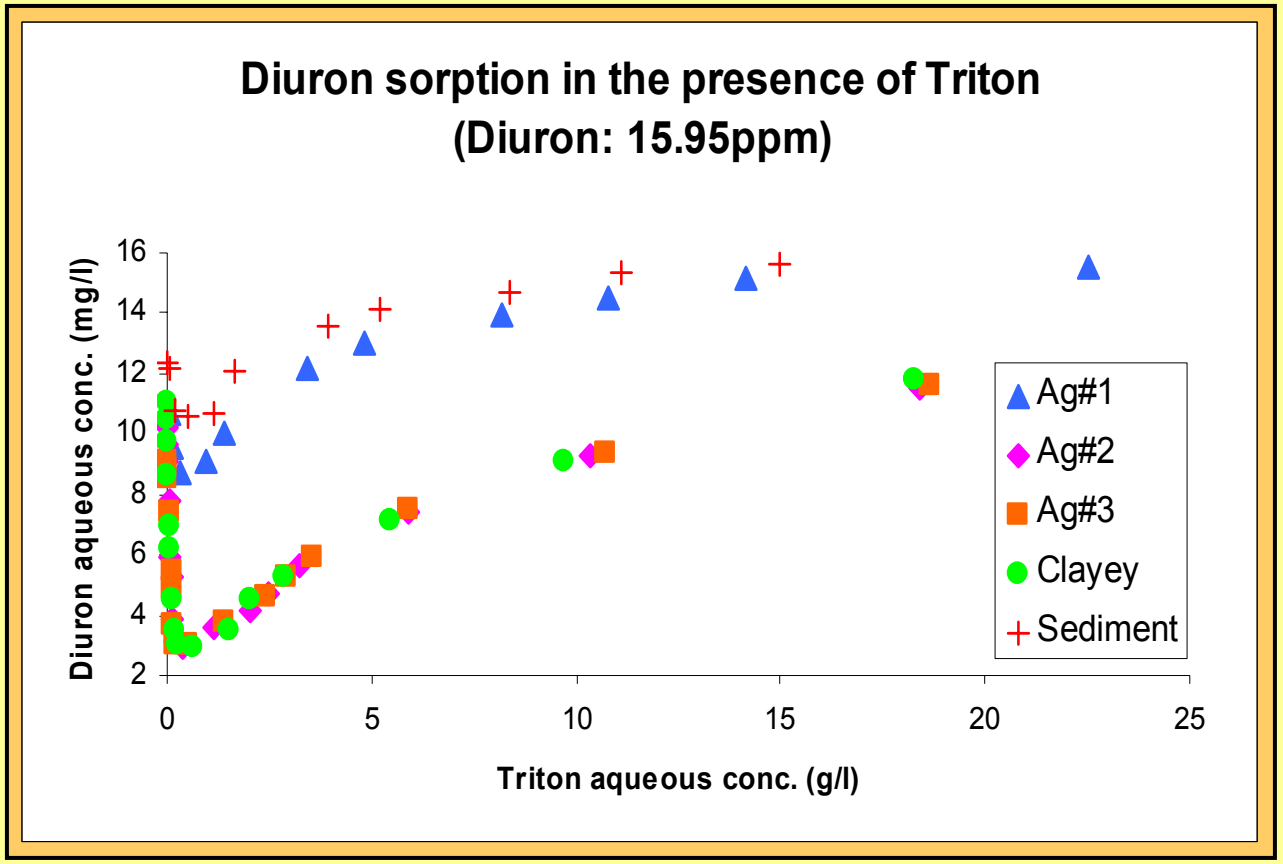
RESULTS



- Soil organic matter (SOM) and the soil clay content are the dominant parameters in terms of pesticide sorption.



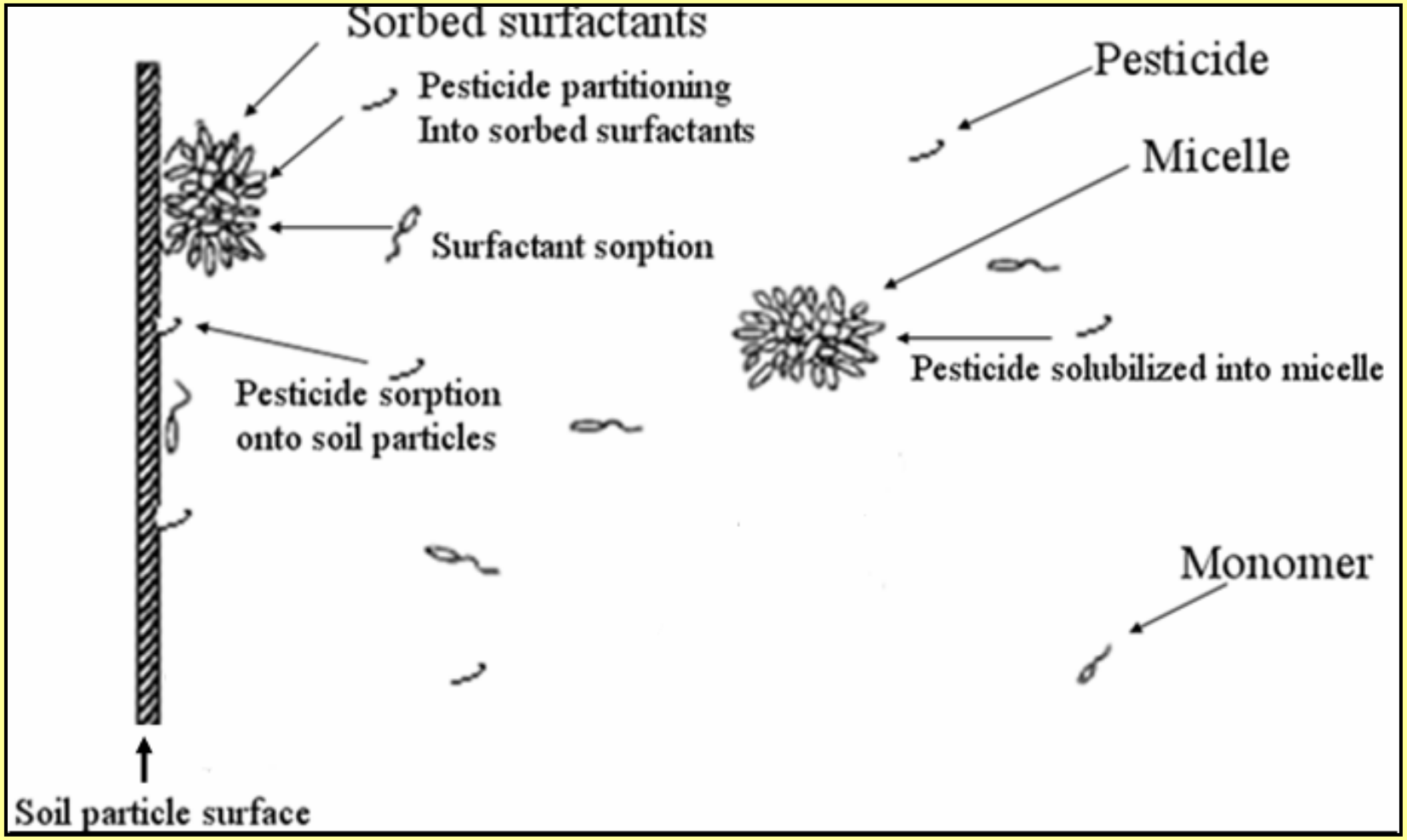
- The triton sorption shows an increase then starts to level off.
- BC, LAS, and SDS shows the same sorption pattern but to a different extent.

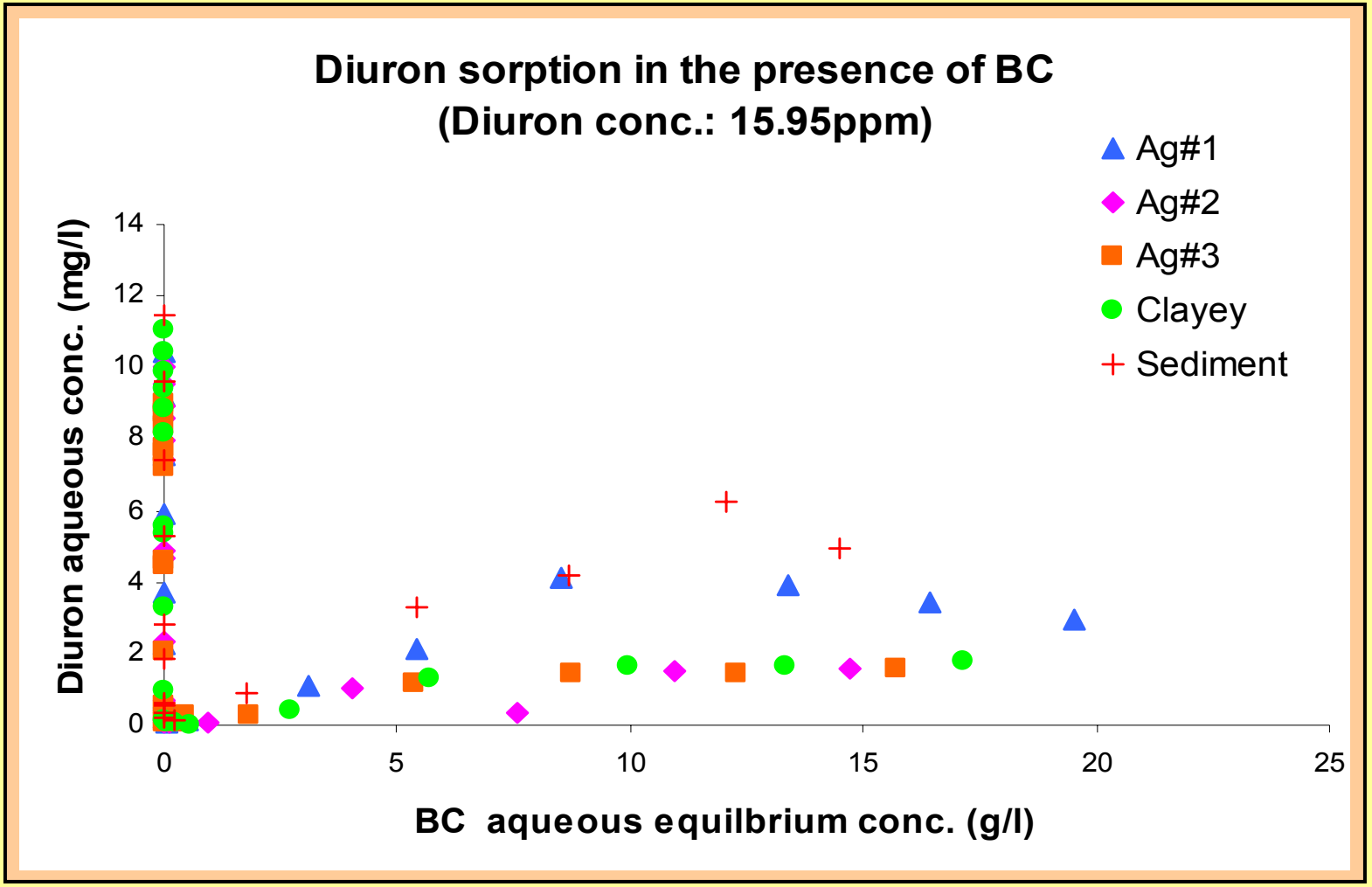


aqueous phase

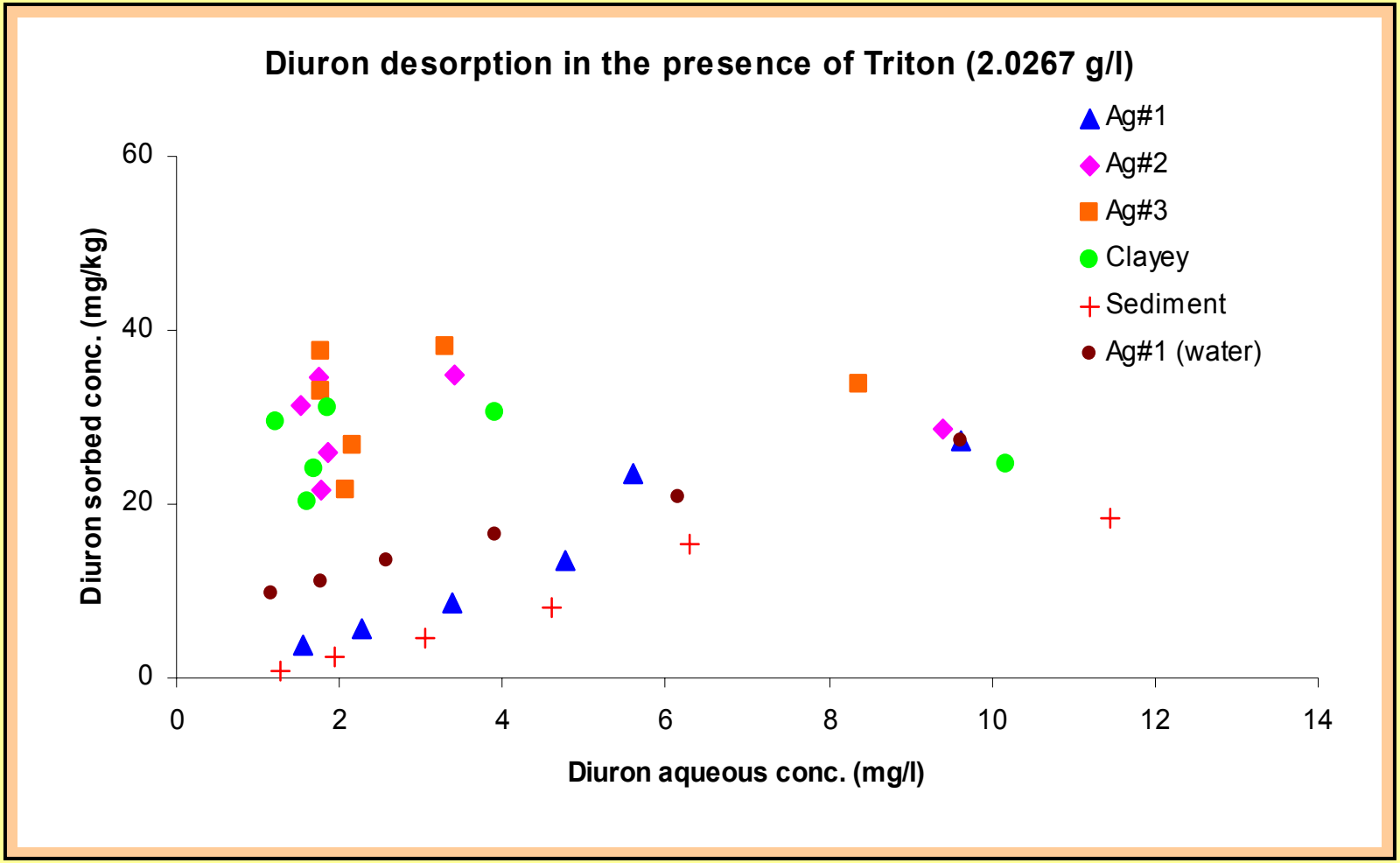
sorbed phase

- In presence of low concentration surfactants, the concentration of pesticide in the sorbed phase increases.


Sorbed surfactants
Pesticide partitioning
Into sorbed surfactants
Surfactant sorption
Pesticide sorption
onto soil particles
Soil particle surface
Pesticide
Micelle
Pesticide solubilized into micelle
Monomer



BC, being a cationic surfactant, sorbs more into the soil particles which explains the much lower Diuron aqueous concentration at the first stage.



Comparing Ag#1 and Ag#1(water), the enhanced desorption happened after cycle #2.

CONCLUSION

- The presence of surfactant has a significant effect in the pesticide partitioning within the soil washing system
- Different surfactants have different potential to enhance pesticide desorption. This enhancement is surfactant and soil dependent.
- The enhanced desorption happens only if the surfactant concentration is higher than a certain value which is also surfactant and soil dependent.

FUTURE PLANS

- Statistical Analysis on the experimental data to determine which parameters are dominant in terms of surfactant sorption.

- Conduct Batch Experiments to investigate the effect of surfactant on dispersion of soil particles especially of soil colloidal particles (<2μm).

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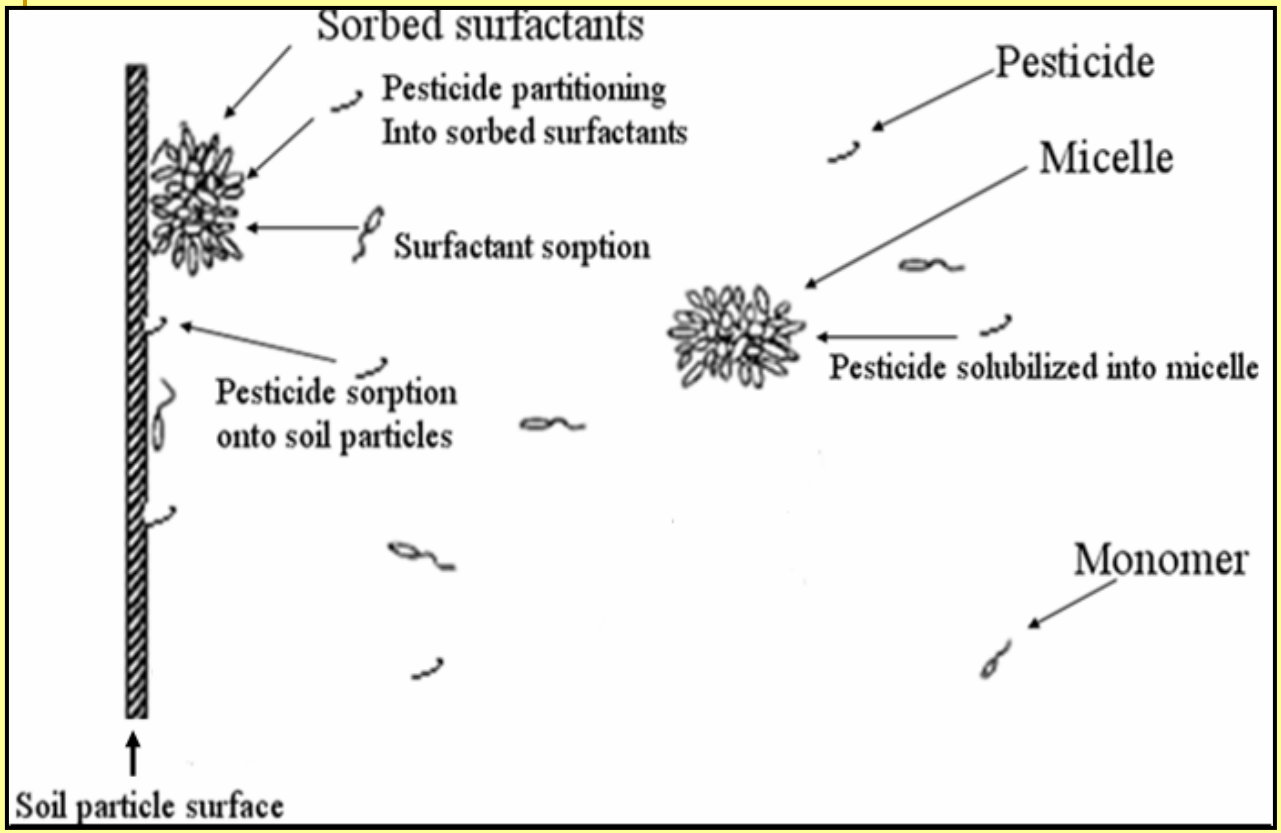
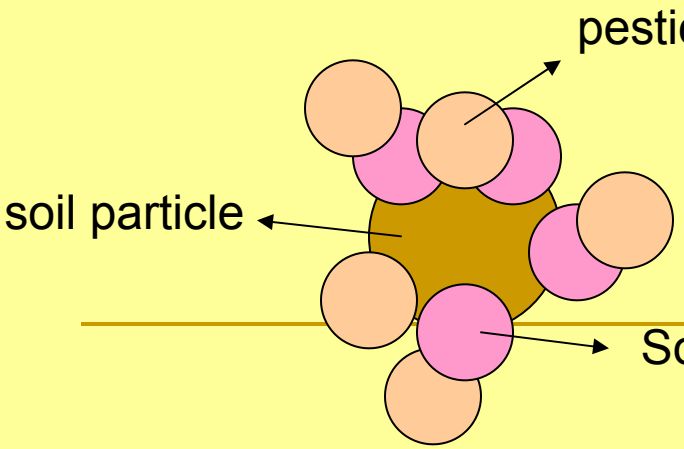
Contra Costa College

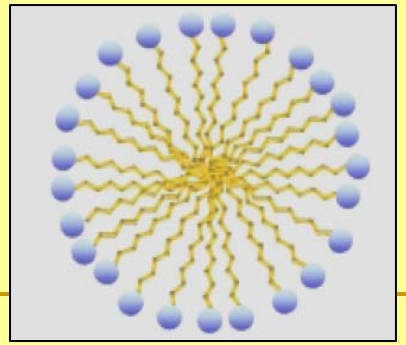
QUESTIONS?

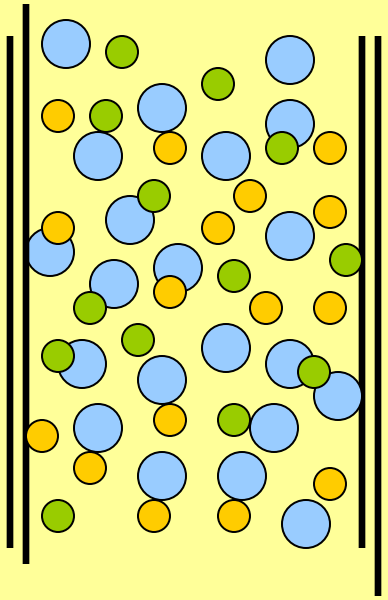


aqueous phase

sorbed phase

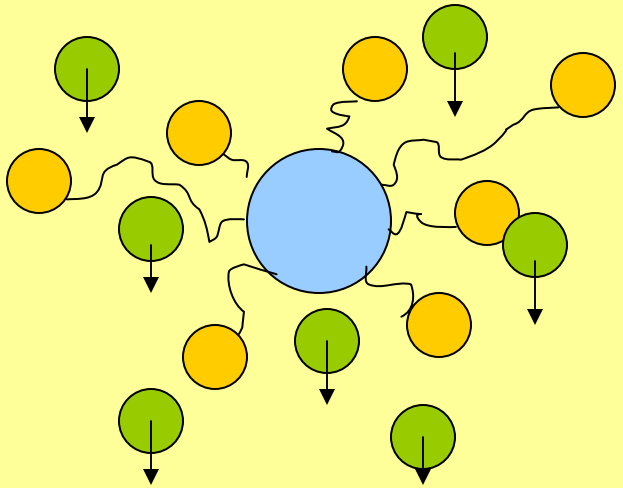






chemicals
hydrophobic
less hydrophobic

silica particulate



SOIL PROPERTIES

	Clay	Silt	Sand
Ag#1	11.0%	13.5%	75.5%
Ag#2	18.8%	23.4%	57.8%
Ag#3	25.5%	16.4%	58.4%
Clayey	15.0%	28.2%	56.8%
Sediment	3.1%	13.0%	83.9%