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APPENDICES

APPENDIX A

Material Safety Data Sheet of Calcium Lignosulfonate (www.sigma-aldrich.com)

1. Product and Company Information

Product Name LIGNOSULFONIC ACID, CALCIUM SALT

Product Number 471054

Company Sigma-Aldrich Pte Ltd #08-01 Citilink Warehouse Singapore 118529
Singapore

Technical Phone # 65 271 1089 Fax 65 271 1571

2. Composition/Information on Ingredients

Product Name	CAS #	EC no
LIGNOSULFONIC ACID, CALCIUM SALT	8061-52-7	None

3. Hazards Identification

SPECIAL INDICATION OF HAZARDS TO HUMANS AND THE ENVIRONMENT:

Not required according to Directive 67/548/EC

4. First Aid Measures

AFTER INHALATION:

If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

AFTER SKIN CONTACT:

In case of contact, immediately wash skin with soap and copious amounts of water.

AFTER EYE CONTACT:

In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

AFTER INGESTION:

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

5. Fire Fighting Measures

EXTINGUISHING MEDIA:

Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

SPECIAL RISKS:

Specific Hazard(s): Emits toxic fumes under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

APPENDIX B

1. Floatability of plastics content (%)

$$F = \frac{A}{B} \times 100$$

A = plastics content that float to the surface of the medium

B = total plastics in the feed

F = plastics floatability in %

2. Plastics recovery (%)

$$W = \frac{B}{A} \times 100$$

A = plastics content of feed

B = plastics content of tailing (in case of plastics that sank into the bottom of column)

B = plastics content of floating (in case of plastics that floated to the surface of column)

W = plastics recovery in %

3. Recovered plastics purity content

$$P = 100 - \left[\frac{C}{R} \times 100 \right]$$

P = plastics purity in %

C = content of plastics A in contaminated with plastics B

R = plastics content of feed

For example, to separate a mixture of PET and PVC with content 3 g each. It was found that 2.705 g of PVC separate from PET/PVC by 500 mg/l CaLS at pH 11 and 4 minutes condition time. While, the left sank to the bottom of the flotation column. When considering PET, it was found that 2.097 g of PET remained at the bottom of the column.

$$\begin{aligned} \text{Floatability of PET} &= (0.903 / 3) \times 100 \\ &= 30.1 \% \end{aligned}$$

$$\begin{aligned} \text{Floatability of PVC} &= (2.705 / 3) \times 100 \\ &= 90.17 \% \end{aligned}$$

$$\begin{aligned} \text{Recovered PET} &= (2.097/3) \times 100 \\ &= 69.9 \% \end{aligned}$$

$$\begin{aligned} \text{Recovered PVC} &= (2.705 / 3) \times 100 \\ &= 90.17 \% \end{aligned}$$

$$\begin{aligned} \text{Purity of Recovered PET} &= 100 - \{(0.295 \times 100)/2.392\} \\ &= 87.67 \% \end{aligned}$$

$$\begin{aligned} \text{Purity of Recovered PVC} &= 100 - \{(0.903 \times 100)/3.068\} \\ &= 70.57 \% \end{aligned}$$

APPENDIX C

The surface tension of medium solution in flotation technique: CaLS can reduce dramatically liquid surface tension (γ_{LG}).

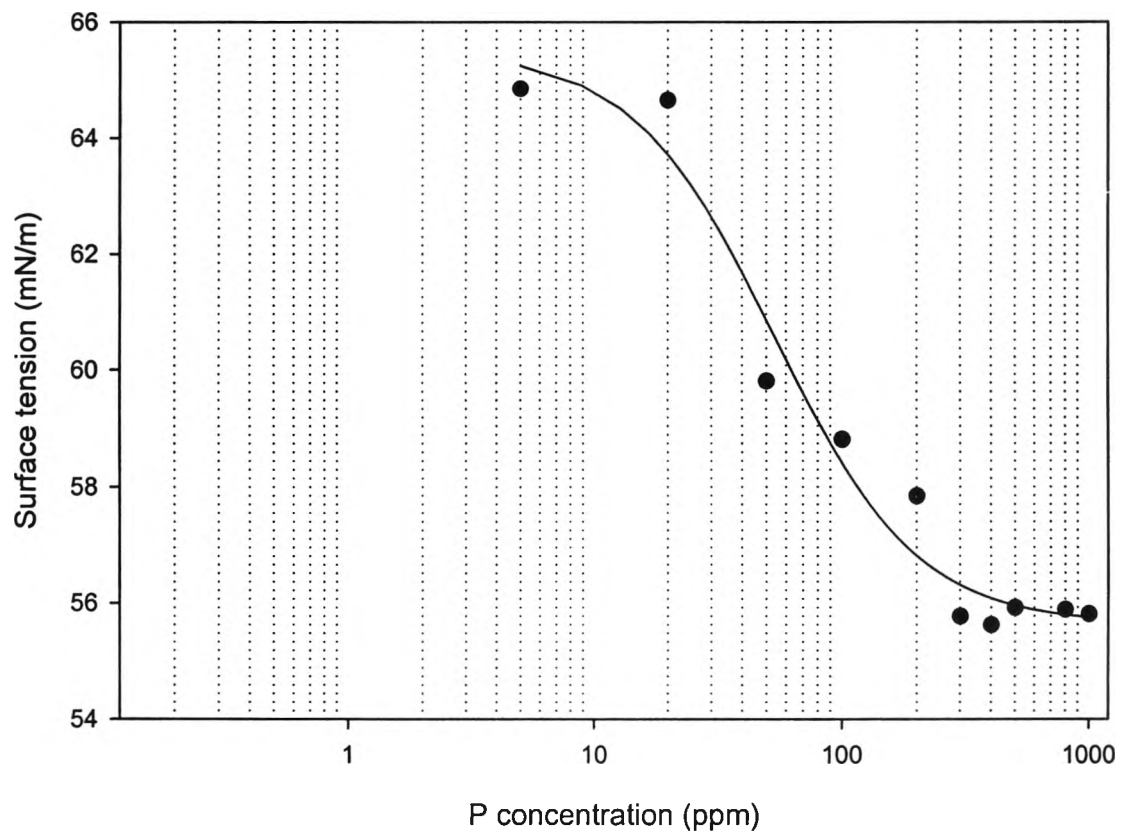


Figure C.1 Effect of wetting agent (CaLS) on the surface tension of flotation medium (pH 7, 25 °C)

APPENDIX D

The average of density of medium solution that used in flotation experiments

Table D.1 Densities of medium solution at various concentration of wetting agent
(medium solution is water)

Medium solution (CaLS: mg/l)	Density (g/cm ³)
0	1.00
20	1.00
50	1.00
100	1.00
200	1.00
300	1.00
400	1.00
500	1.00

Table D.2 Densities of medium solution at various concentration of electrolyte (CaCl₂)
at CaLS 500 mg/l

Medium solution (CaCl ₂ : %w/v)	Density (g/cm ³)
0	1.00
0.1	1.01
0.3	1.01
0.5	1.01
0.7	1.02
0.9	1.03

Table D.3 Densities of medium solution at various concentration of wetting agent
(medium solution is 20 %v/v ethyl alcohol)

Medium solution (CaLS: mg/l)	Density (g/cm ³)
0	0.97
20	0.97
50	0.97
100	0.97
200	0.97
300	0.98
400	0.98
500	0.98

Table D.4 Densities of medium solution at various concentration of electrolyte (CaCl₂)
at CaLS 500 mg/l

Medium solution (CaCl ₂ : %w/v)	Density (g/cm ³)
0	0.97
0.1	0.98
0.3	0.98
0.5	0.98
0.7	0.98
0.9	0.98

BIOGRAPHY

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Qualification

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Undergraduate: Faculty of Science, Chulalongkron University

Master degree: National Research Center for Environmental and Hazardous Waste Management, Chulalongkron University

