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The use of lanthanum (La^{+3}) and Cerium (Ce^{+3}) ions as phosphate activators in low grade phosphate flotation

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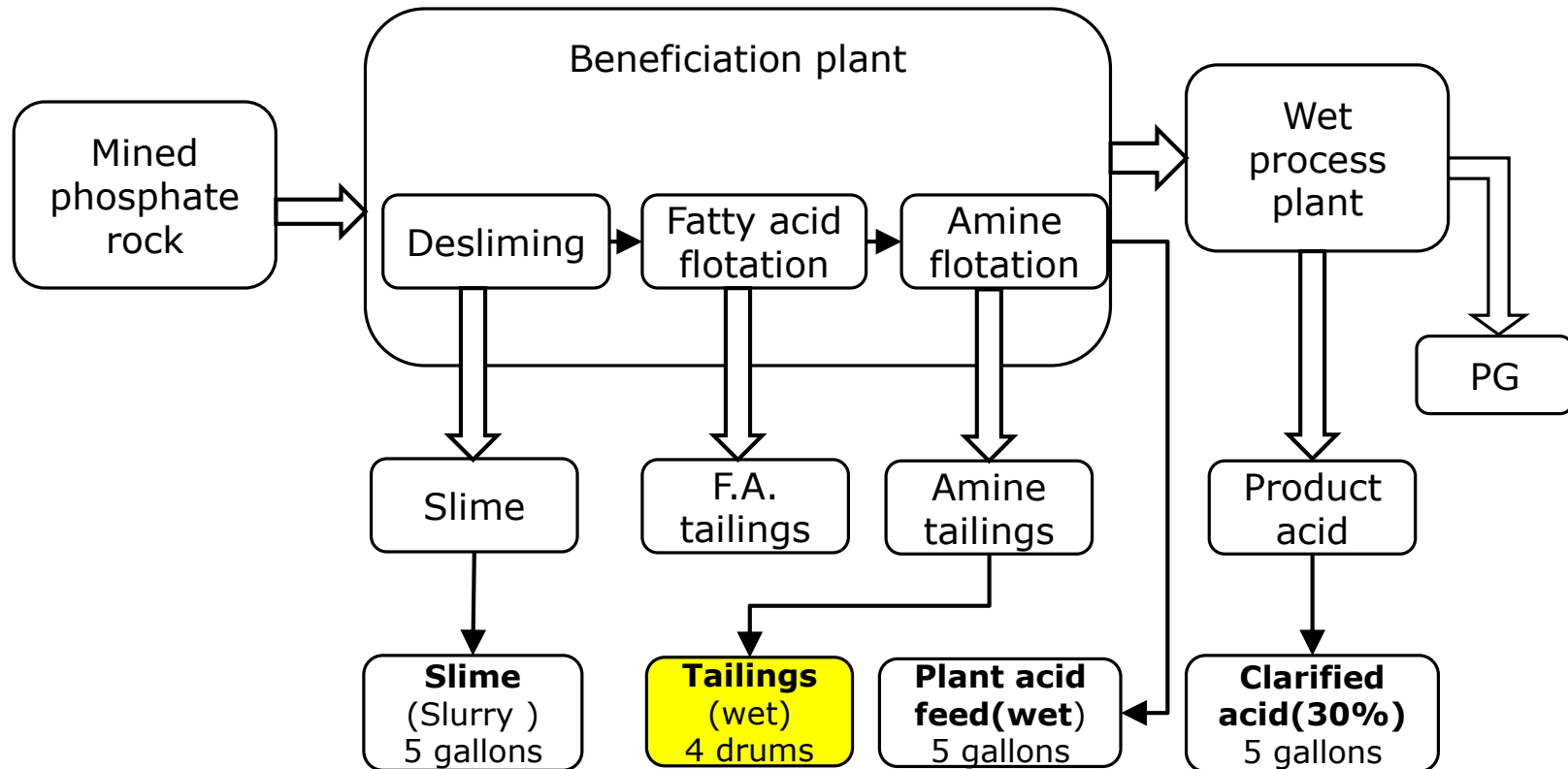
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The use of lanthanum (La^{+3}) and cerium (Ce^{+3}) ions as phosphate activators in low grade phosphate flotation

**Salah Al-Thyabat
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Samples Preparation



The use of lanthanum (La⁺³) and cerium (Ce⁺³) ions as phosphate activators in low grade phosphate flotation

Samples Preparation

- Amine tailings (AT):
 - 5 kg were separated from each drum .
 - Drying in oven (105 c) for 24 hrs
 - Mixing, quartering and conning ,
 - splitting into 5 kg fractions in a sealed plastic bags,
 - representative sample were chosen for sieve size and chemical analysis.

Flotation tests

- ❑ Mechanical flotation(Denver D-12C)
- ❑ Conditioning at 57% solids
- ❑ Conditioning time with activator for 2min
- ❑ Conditioning for extra 5 min with collector.
- ❑ pulp diluted to 25 %
- ❑ Flotation for 5 min.
- ❑ Cleaning and scavenging flotation conducted for 5 min.

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Flotation reagents

- The collector (Oil1):
 - ❑ waste oil saponified with diluted soda ash solution (2%). [40 g/L]
 - ❑ 10 ml of 3M TBP (99% TBP diluted with Kerosene) was added.
- The activator (Act1):
 - ❑ 10 ml La^{+3} standard(1000ppm)
 - ❑ 10ml Ce^{+3} standard(1000ppm)
 - ❑ 50ml of 2% soda ash

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Feed characteristics

- $D_{50} = 150\mu\text{m}, D_{100} = 250\mu\text{m}$

Size (μm)	%wt	%wt						
		P_2O_5	CaO	MgO	Al_2O_3	Fe_2O_3	A.I	LOI
-250+210	10.6	1.8	2.2	0.01	0.48	0.15	91.3	
-210+177	10.0	1.6	2.2	0.01	0.30	0.14	92.5	
-177+149	25.3	2.0	3.1	0.01	0.17	0.19	90.2	
-149+105	39.5	3.2	5.0	0.02	0.20	0.32	86.9	
-105+74	12.2	4.3	6.5	0.04	0.32	0.69	83.0	
-74+53	2.4	4.5	6.7	0.08	0.43	1.6	81.1	
feed		2.8	4.2	0.02	0.25	0.37	88.9	1.6

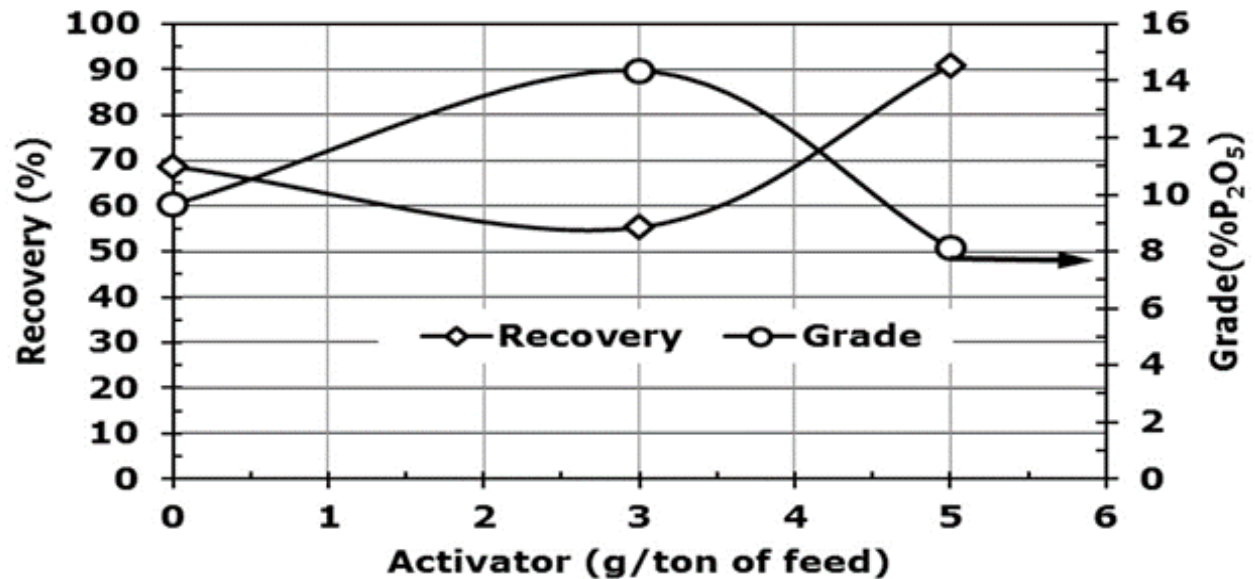
The use of lanthanum (La+3) and cerium (Ce+3) ions as phosphate activators in low grade phosphate flotation

Results and discussion

- Collector(1000g/tonne)-activator dosage varied
 - Concentrate grade increased by 50 % (9.5 to 14.5% P_2O_5).
 - Recovery increased from 70% to approximately 90% .

Results and discussion

- Collector(1000g/tonne)-activator dosage



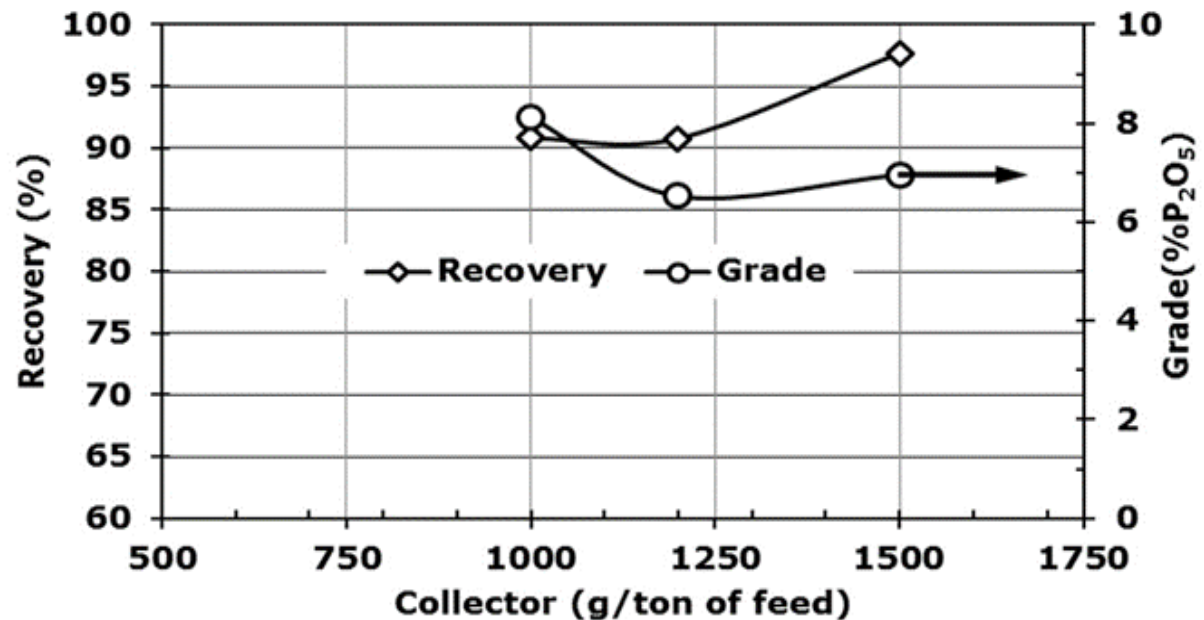
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Results and discussion

- Activator(5g/tonne)- collector dosage varied
 - Concentrate grade slightly reduced(8.5-7% P_2O_5) when collector dosage increased from 1000 to 1500g/tonne.
 - phosphate recovery slightly increased from 90% to 97%

Results and discussion

- Activator(5g/tonne)- collector dosage varied



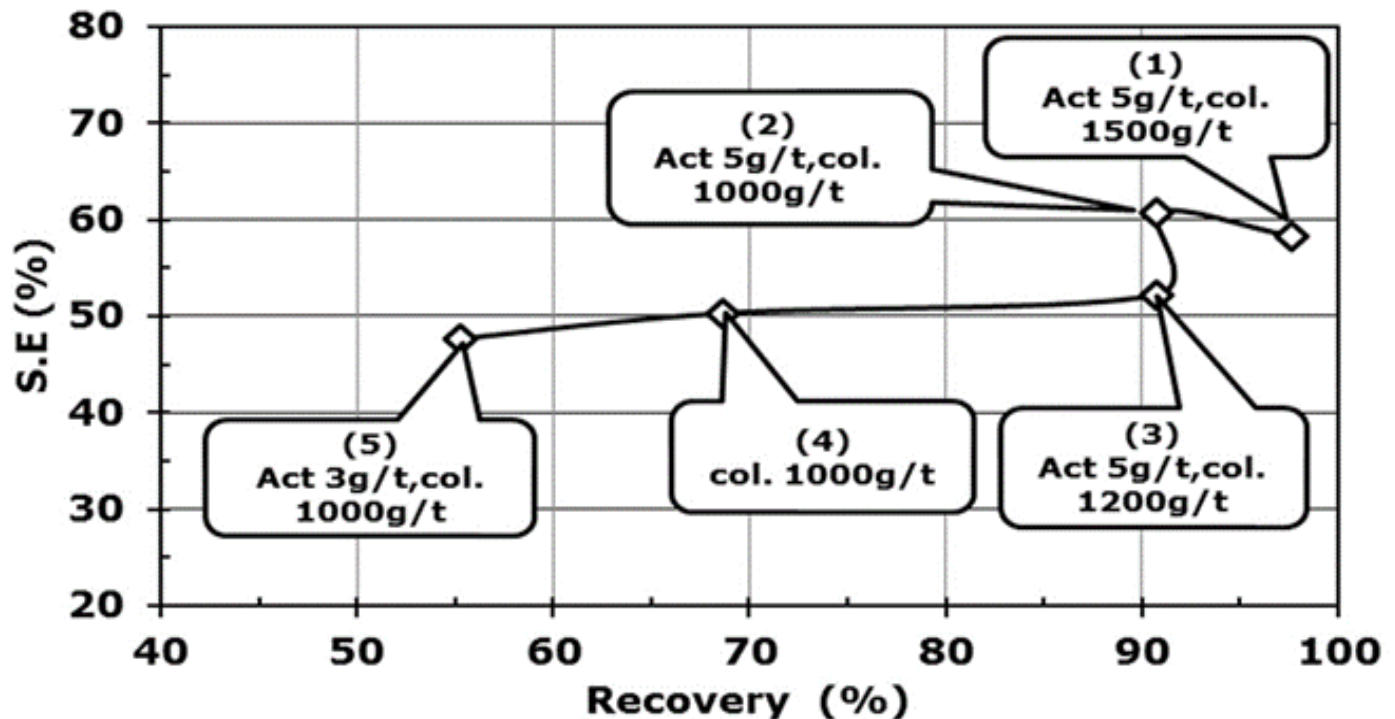
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Results and discussion

- Separation efficiency & recovery
- *Separation Efficiency (S.E) =*
$$P_2O_5 \text{ Recovery} - \text{Gangue Recovery}$$
- highest separation efficiency at 5 g/tonne activator and 1000g/tonne collector.
- The highest concentrate grade and lowest recovery at 3g/t activator and 1000 g/t collector
- activator reduces collector consumption!!

Results and discussion

- Separation efficiency & recovery



The use of lanthanum (La⁺³) and cerium (Ce⁺³) ions as phosphate activators in low grade phosphate flotation

Results and discussion

- Collector-Activator & direct flotation

	Fatty acid / waste oil (g)	TBP(g)	Kerosene/Fue l oil (g)	2% Soda ash(ml)
Fatty acid	2	**	1.3	50
Oil I	2	2	1.3	50

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Results and discussion

- Collector-Activator & direct flotation
- performance the fatty acid collector and the waste oil collector are identical (Test 1 & 2).
- The addition of activator to waste oil collector increased concentrate grade by approximately 50%, but reducing recovery

Results and discussion

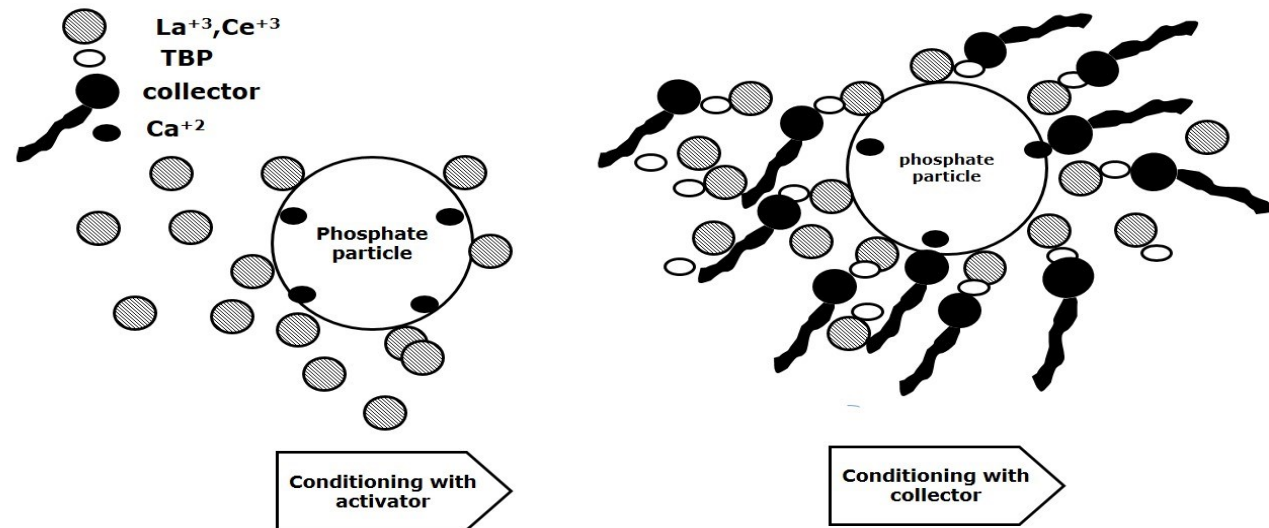
- Collector-Activator & direct flotation
- collector selectivity was increased by the activator addition!!!(require validation by adsorption tests).
- low recovery due activator dosage may be improved by scavenging flotation of the tailings%.

Results and discussion

- Possible explanation for activator-collector behavior (adsorption tests required).
 - ❑ The conditioning with the activator introduced La^{+3} and Ce^{+3} ions into the pulp.
 - ❑ The ions may attach selectively to phosphate particles due to similarity in size between these trivalent ions and calcium cations.
 - ❑ similarity causes isomorphs substitution with calcium cations, responsible for chemisorption between fatty acid collector and phosphate particles .
 - ❑ The solvent (TPB) works as complexing agent (bridge) between these trivalent and the fatty acid collector

Results and discussion

- Possible explanation for activator-collector behavior (adsorption tests required).



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Thank you