STUDIES ON SEPARATION OF IRON OXIDE AND FLOTATION OF SILICA FROM KASHMIR BAUXITE

By P. K. Deshpande and G. N. Bhat

(Department of Chemical Technology and Chemical Engineering, Indian Institute of Science, Bangalore-3)

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Different bauxite consuming industries generally demand bauxites of varying specifications.[1] Aluminium and chemical industries desire to have the iron oxide content in the raw material bauxite less than 6 and 2 per cent. respectively. This paper presents results of flotation experiments designed to separate iron oxide and silica from bauxite.

Materials, Methods and Results

The sample of bauxite and methods of analysis are the same as used in the previous investigation.[2] Effects of aniline, T.T. mixture (*o*-toluidine + Thiocarbanilide 1 : 1) and sodium hexametaphosphate as depressants for iron oxides under different pH conditions were studied and the results are represented graphically in Figs. 1, 2 and 3.

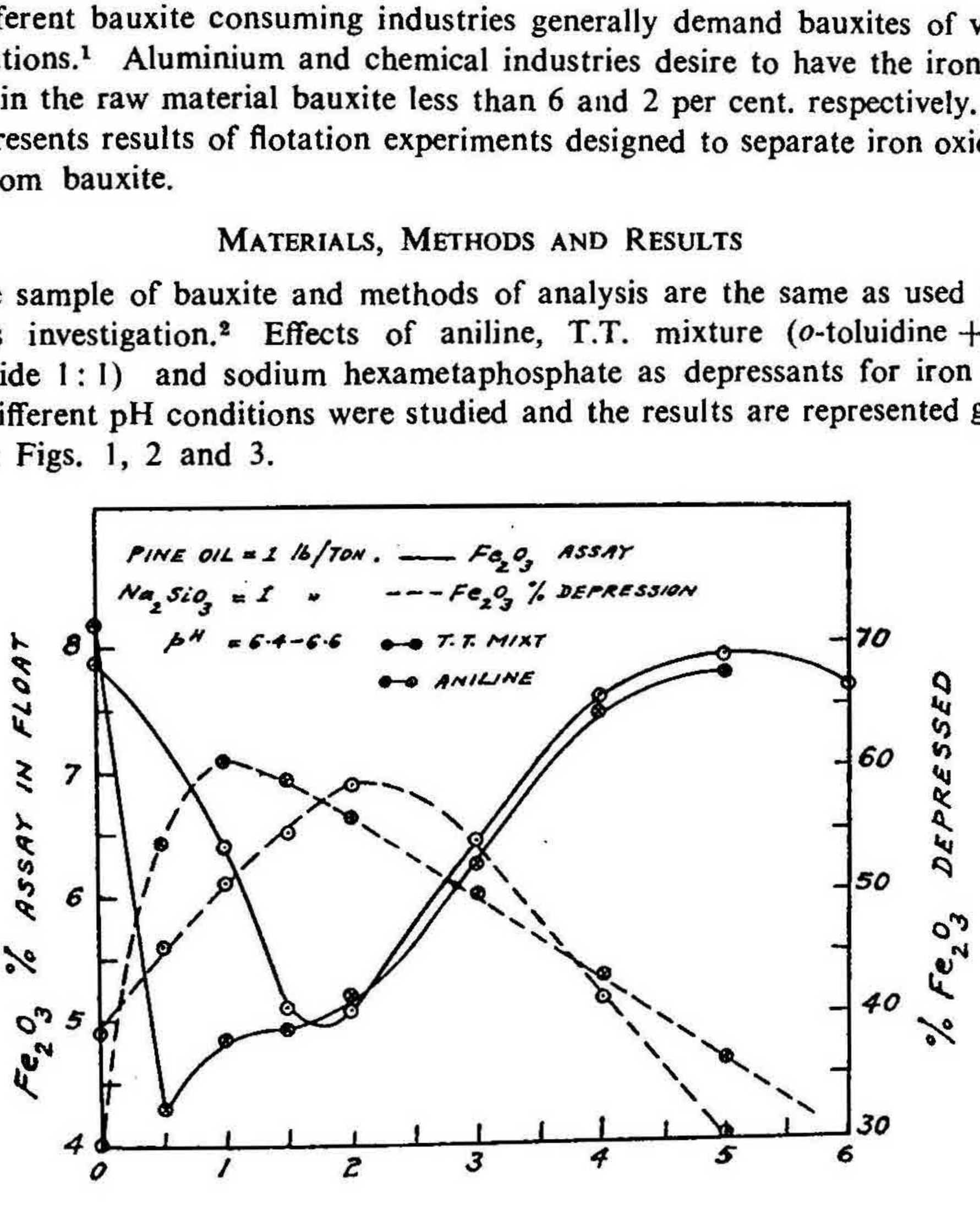

Fig. 1. Effect of Aniline and T.T. Mixt. on the Depression of Fe_2O_3

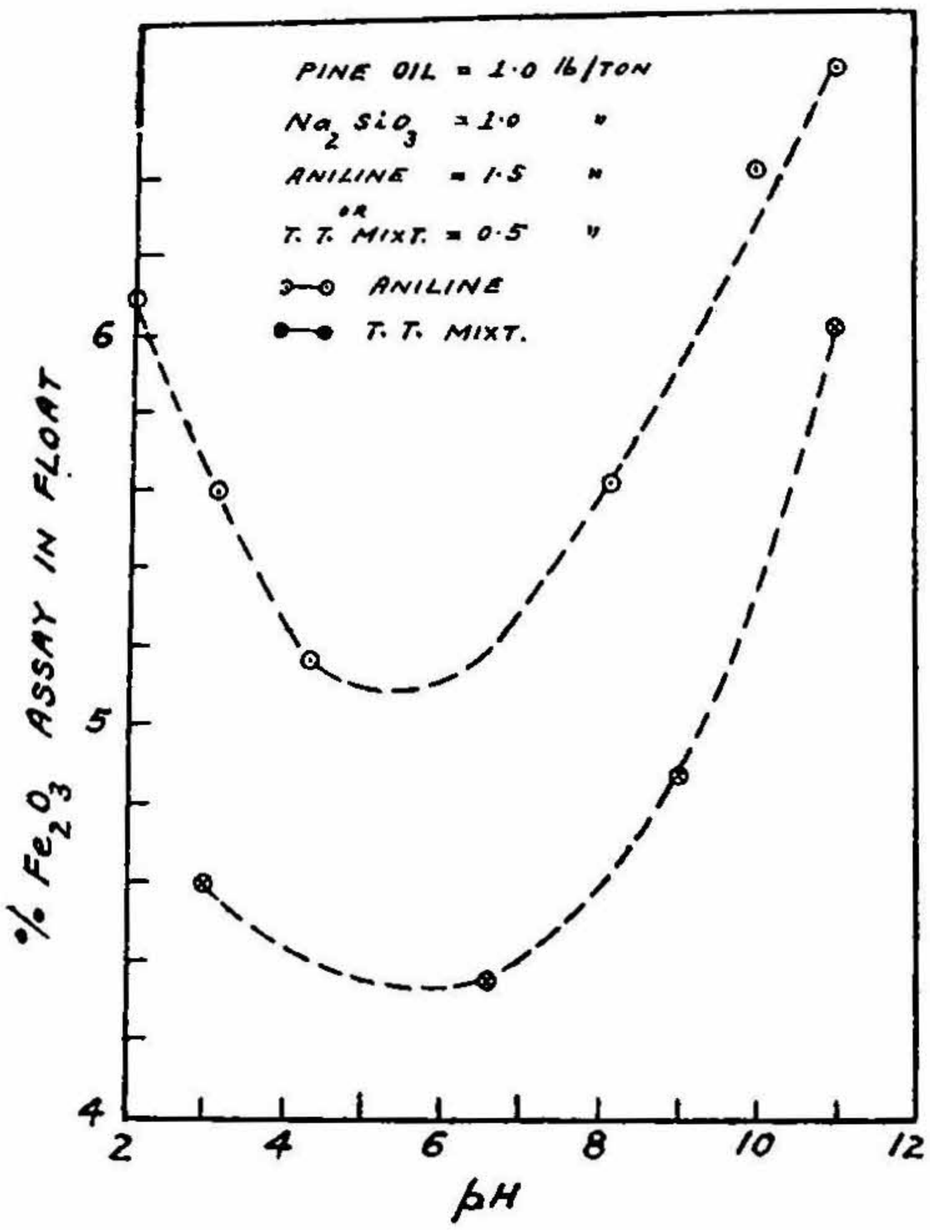

FIG. 2. Effect of pH on the Depression of Fe_2O_3

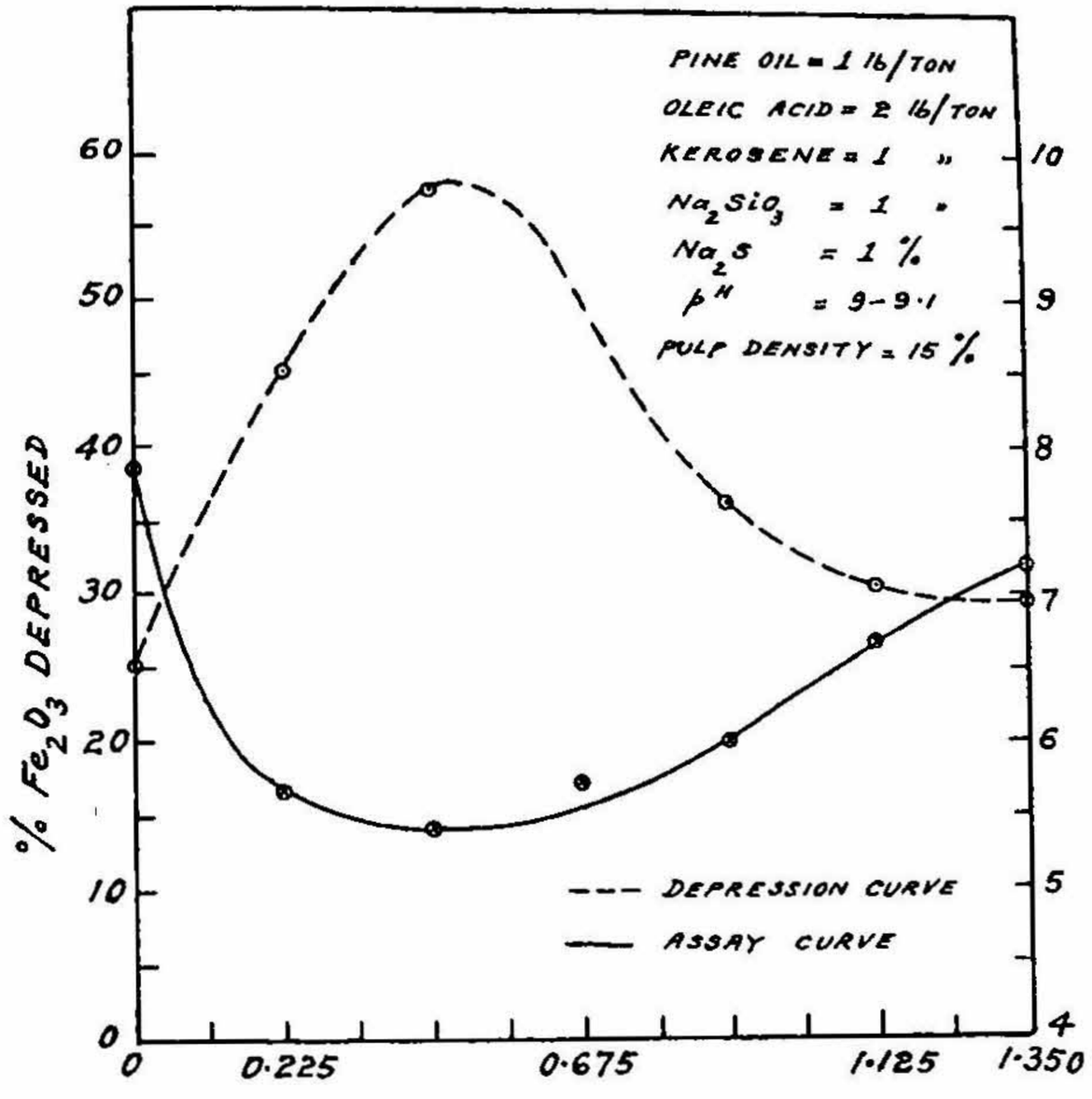

FIG. 3. Depression of Fe_2O_3 by Sodium Hexametaphosphate

Bauxite samples were roasted for half-an-hour in a reducing atmosphere in a furnace in order to favour the reduction of hematite in the ore to magnetite. The roasted mass was dropped in cold water, dried and subjected to dry magnetic separation in a Sterns laboratory magnetic separator. Roasting at different temperatures were studied and the overall results are given in Table I.

TABLE I

Fractions	Wt. %	Ignition loss %	SiO_2 %	Fe_3O_4 %	TiO_2 %	Al_2O_3 %	Separation of iron oxide %
Temperature 450° *C.*							
Concentrate ..	20	3·12	12·81	34·13	4·30	45·64	67·45
Tailings ..	80	8·10	11·71	4·12	3·21	72·86	
Composite ..	100	7·10	11·93	10·12	3·42	67·62	
Temperature 550° *C.*							
Concentrate ..	15	3·50	12·40	25·94	4·50	53·66	43·24
Tailings ..	85	7·90	11·80	6·01	3·22	71·06	
Composite ..	100	7·24	11·89	9·00	3·41	68·46	
Temperature 650° *C.*							
Concentrate ..	30	5·41	12·21	16·91	3·91	61·56	50·26
Tailings ..	70	7·85	11·78	7·18	3·21	69·98	
Composite ..	100	7·12	11·91	10·10	3·42	67·45	
Temperature 750° *C.*							
Concentrate ..	35	5·86	12·06	14·05	3·75	64·28	48·50
Tailings ..	65	7·82	11·83	8·02	3·22	69·11	
Composite ..	100	7·14	11·92	10·14	3·42	67·38	

Experiments were also carried out to depress silica from the original one in the first instance and subsequently depress iron oxide from the concentrate so obtained. Results are given in Table II.

TABLE II

Reagents used	Ignition loss %	SiO_2 %	Fe_2O_3 %	TiO_2 %	Al_2O_3 %	% Al_2O_3 recovery
(A) Original ore	14·15	11·81	7·90	3·41	62·73	..
(B) Oleic acid, Pine oil, Kerosene, Sod. silicate	14·73	6·88	7·93	3·14	67·32	65·19
(C) Aniline, Pine oil ..	14·78	6·89	4·98	3·14	70·21	65·19
(D) T.T. mixture, Pine oil	14·77	6·88	4·41	3·15	70·79	64·79
(E) Sod. hexametaphosphate, Pine oil ..	14·81	6·86	5·33	3·14	69·86	63·96
(F) Oleic acid, Pine oil, Kerosene, Sod. silicate, Sod. hexametaphosphate	14·84	6·71	5·44	3·12	69·89	81·96

[Concentrate 'B' was floated in (C), (D) and (E)]

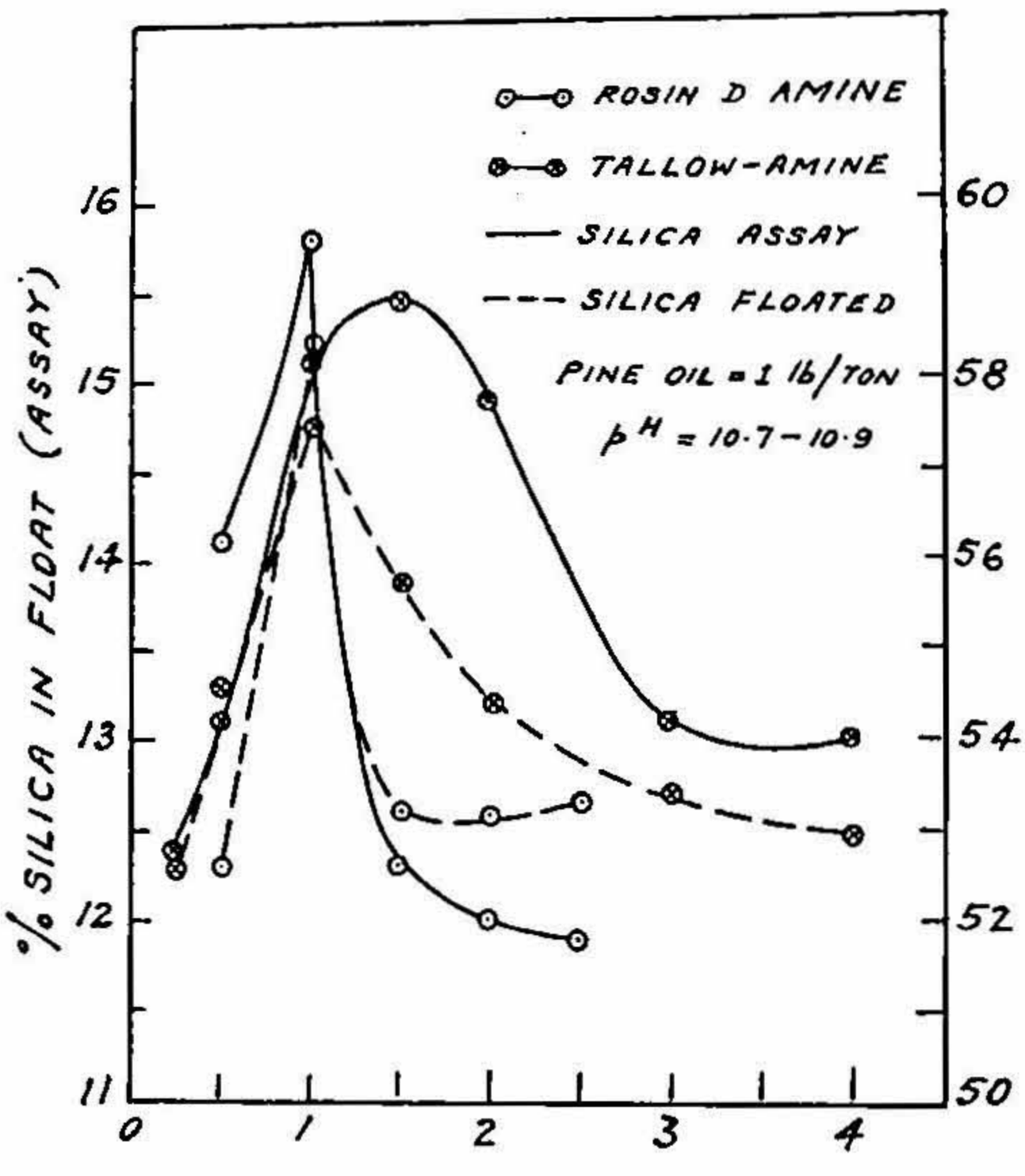

FIG. 4. Effect of Amines on the Flotation of Silica

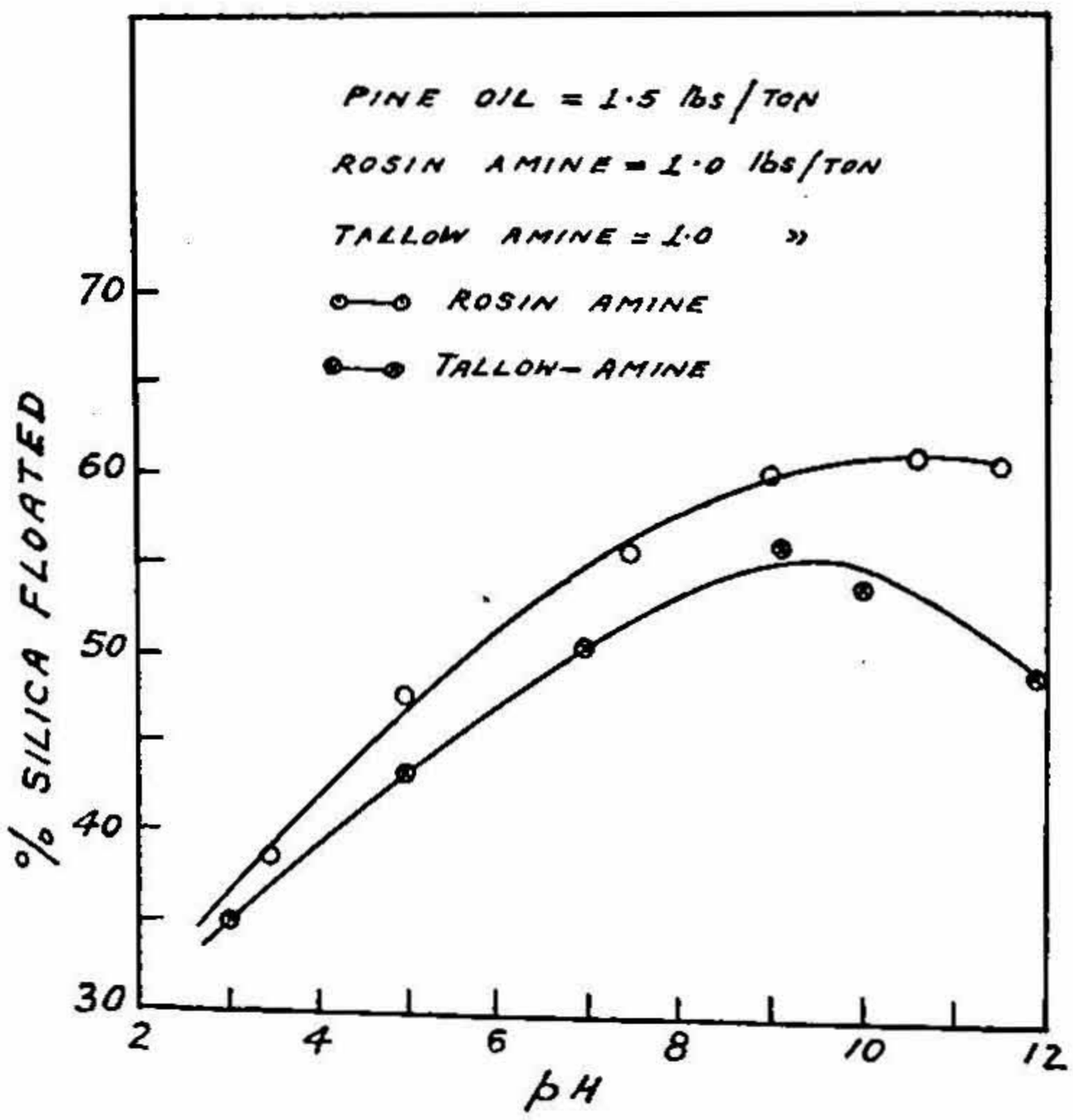

FIG. 5. Effect of pH on Silica Recovery

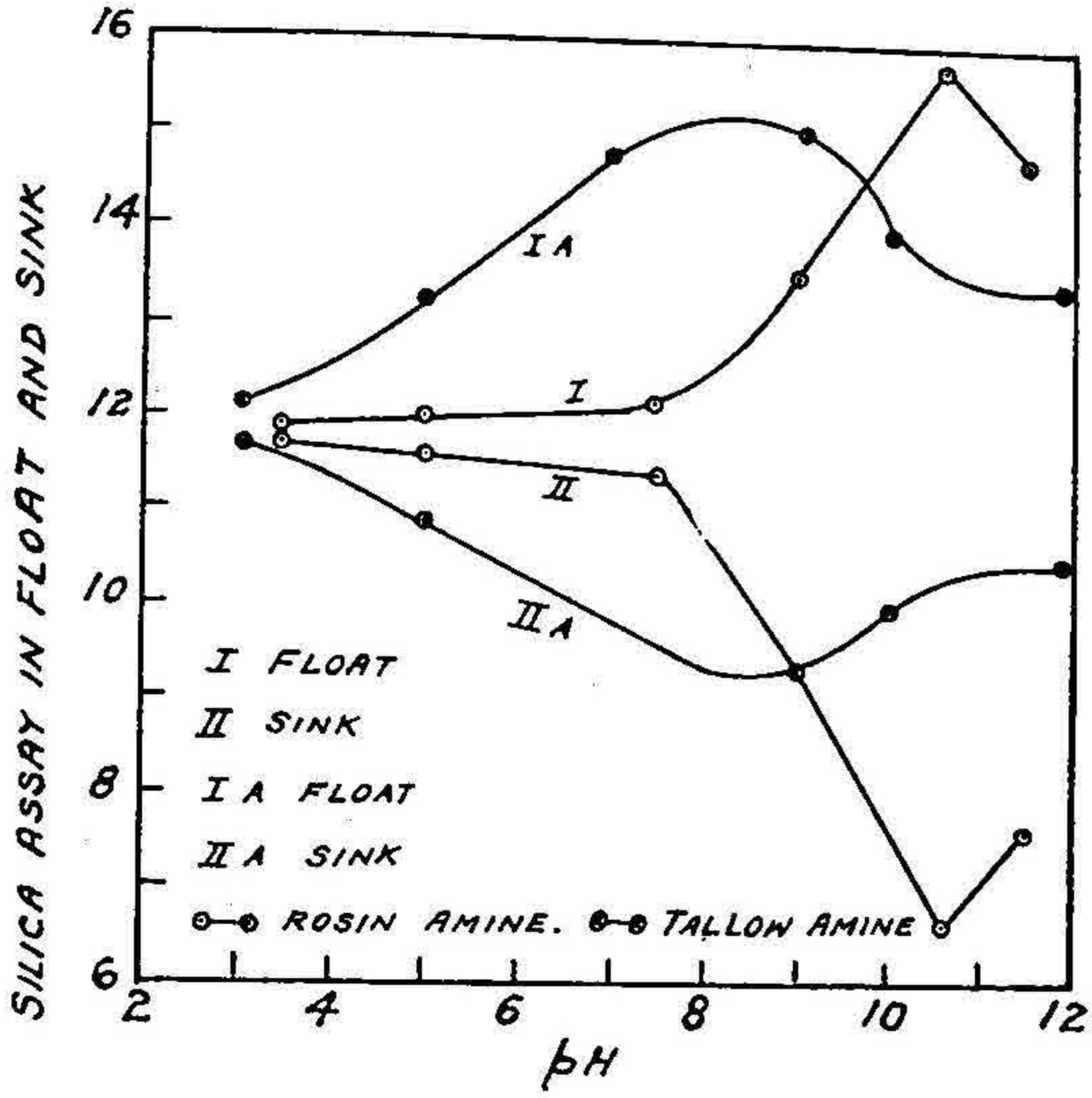

FIG. 6. Effect of pH on the Composition

Influence of Rosamine D Acetate (Herculus Powder Co., Washington) and of 'Tallow Amine Acetate" (Armour & Co., Chicago) as cationic collectors on the flotation of negatively charged silica in bauxite was a'so studied at different pH conditions. The results are given in Figs. 4, 5 and 6.

DISCUSSION

Fatty acids used in the flotation of alumina would also act as collectors for iron oxide[3] with consequent flotation of alumina and iron oxide together. Aniline and T.T. mixture worked effectively 'n depressing iron oxide (Fig. 1), but these reagents did not depress silica. Both the depressants were effective in acidic circuits only, with optimum results at pH 6·0 (Fig. 2). When sodium hexametaphosphate was, however, used in conjunction with oleic acid and sodium silicate, it depressed iron oxide efficiently without affecting the depression of silica by sodium silicate (Fig. 3).

More efficient removal of iron oxide was obtained by magnetic separation than by flotation. Lower roasting temperature seemed to favour better iron oxide separation. Such may be the case due to the reduction of hematite being favoured by lower temperature (Table I).

Two-stage flotation yielded a better grade of concentrate but the overall alumina recovery in the final concentrate was only 65 per cent. On the other hand, the recovery noticed during single stage flotation using oleic acid, sodium silicate and sodium hexametaphosphate was of the order of 82 per cent., the grade of the product being equally satisfactory (Table II).

The action of the two amines on the flotation of silica seems to be nearly the same (Fig. 4). This may be due to the fact that almost all the amines give maximum contact angles of the order of 60° as found by Wark and Wark.[4] Floatability of silica was found to increase with increasing pH (Figs. 5 and 6). Talmud and Lubman[5] have also observed that SiO_2 floats more readily in alkaline circuits. But, it was noticed that when low percentage of silica assay in the sink (concentrate) was obtained, alumina recovery in the sink was also low and the iron oxide assay varied from 6·67 per cent. to 7·81 per cent. Thus, better grade of sink with respect to silica and iron oxide and maximum alumina recovery could not be obtained at the same time.

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