ON THREE SAMPLES OF CRUDE PETROLEUM.

By Durand Woodman, Ph. D.

1st. A sample of crude oil from the Lima, O., field. Sp. Gr. at 60° F. (15.5° C)=0.835 (39° B). Color, brown; slight fluorescence. Odor, peculiar and disagreeable.

2d. A sample of crude oil from California. Sp. Gr. at 60° F., 0.835 (=39.0° B). Color, dark brown, opaque; no appearance of fluorescence except on dilution. Odor, peculiar; quite different from the Lima oil, and not as disagreeable. The odor of some of the distillates from these oils was much intensified.* Some of the California distillates had an agreeable odor.

300 c.c. of these oils were taken for distillation. The receiver was changed at every 15 c.c. = 5%. Thermometer bulb opposite exit of retort. Temperature taken at moment of removing the receiver.

Each distillation occupied four hours. The results are tabulated in the accompanying table.

TABLE OF DISTILLATES.

	t° F.		Sp. Gr. at 60° F. (15.5° C)		°B.		Per Cent.
	Lima.	Cal.	Lima.	Cal.	Lima.	Cal.	
1	160°	160°	0.704	0.706	70°.5	70°.0	5
2	200°	184°	.723	.716	65 .0	67 .	10
3	210°	200°	.737	.735	61 .0	62 .	15
4	250°	218°	.752	.746	57 .5	59 .8	20
5	263°	222°	.767	.761	54 .0	56 .0	25
6	277°	218°	.778	.769	52 .0	53 .8	30
7	348°		.793	.777	48 .0	52 .0	35
8	354°	256°	.806	.791	45 .0	48 .5	40
9	370°	308°	.814	.808	43 .+	45 .0	45
10	400°	316°	.824	.818	41 .0	42 .5	50
11	427°	355°	.831	.834	40 .0	39 .0	55
12		425°	.830	.850	40 .0	36 .0	60
13	476°	430°	.831	.860	39 .0	34 .0	65
14	486°	490°	.835	.874	40 .0	31 .0	70
15	490°	490°	.834	.877	39 .0	30 .5	75
16	486°	484°	.830	.858	40 .0	33 .8	80
17	466°	500°	.825	.853	41 .0	34 .8	85
18	450°	485°	.826	.846	41 .+	36 .5	90
	Residuum		Solid at ordinary t°	Solid at ordinary t°			95
	"		"	"			100

* C.F. Mabery (Am. Chem. Jr., 13, 232) notes that the sulphur compounds collect principally in the distillates of higher boiling points (200°–300°).

The first nine Lima distillates (45 per cent. of the original sample) were water white and have remained so for many months. They were not "refined," but were corked up and set aside immediately after taking the specific gravity.

The tenth distillate was straw yellow, and the color increased to a dark brown in the eighteenth.

The first eight (40 per cent. of the crude oil) of the California distillates were water white, and have remained so.

The ninth was slightly yellow and color increased in the succeeding distillates.

APPROXIMATE CLASSIFICATION OF DISTILLATES.

	Lima.	California.
Naphtha under 0.73 sp. gr	10% +	10% +
Illuminating oil	50% ±	40% ±
"Lubricating" oils	30% ±	40% ±
Residuum	10% —	10% —

The California oil contained:

Sulphur (method of Carius)	0.18 %
Sulphuric acid (oil washed and washings, represented by $Ba\ Cl_2$)	0.0003%
Water	0.27%
Paraffine	none separable.

The oil remained perfectly fluid at — 26° F. (— 32 C.) the viscosity at that temperature being apparently equal to that of "boiled" linseed oil. The heaviest distillates solidified at 0° F. (— 18° C.).

A second sample of Lima oil, received at about the same time as the foregoing, was a somewhat heavier oil. Sp. gr. 0.850 = 36° B., but not differing noticeably in appearance or odor.

It was separated into the following temperature fractions:

		Sp. gr. — = — ° B
At 150° F	0.0 %	
" 250°	13.75%	0.747 = 59.°
" 400°	35.11%	.797 = 47.°
" 500°	7.93%	.830 = 39.°
" 600°	13.40%	.844 = 36.5°
" 600° +	18.60%	.846 = 36.°
Residuum	9.65%	--- ---
Water	0.70%	--- ---
	99.14	

APPROXIMATELY:

Naphtha and burning oil	56.8%
Heavy oils	32.0%
Residuum	9.6%
Water	0.7%
Sulphur, first determination	0.63%
Duplicate	0.68
Average	0.655%

Notwithstanding the strong odor of the Lima oil, the sulphur present seems rarely to amount to 1 per cent. "Analyses of samples of crude Ohio oils from different localities have given on the average about 0.50 per cent. sulphur" (C. F. Mabery and Albert W. Smith. *Loc. cit.*, p. 234).

Sulphur in crude Lima petroleum (average)	0.50%	Mabery & Smith.
" " " "	0.553	Dr. Lord, Ohio Geol. Sur.
" " " (by Carius' method)	0.655	D. Woodman.
Sulphur in crude distillate (Lima)	0.52	Dr. Lord, "Economic Geology" vol., VI., p. 791.
" " refined " "	0.36	"
Another " " "	0.22	"
Sulphur in Pennsylvania crude oil	0.18	D. Woodman.
" (by combustion)	0.22	"

The removal of the sulphur compounds or the destruction of those accountable for the disagreeable odor in Lima oil is a problem still open for a satisfactory solution both in respect to expense and efficiency.

The study of the individual forms in which the sulphur exists, although a most tedious process, holds the surest promise of success.