(Rough Draft - Not Edited)

5a.

BIODEGRADATION STUDIES - 1st Quarter, 1970

Initially our biodegradation studies had two primary objectives, first to determine just how refractory PCBs were to bacterial degradation and secondly to see if bacterial degradation was responsible for the conspicuous absence of selected PCB isomers. As experience was gained it became obvious that a third objective should be added, namely, to determine how useful these laboratory biodegradation techniques might be as environmental screens for PCB replacement products that were being developed.

Two techniques have been employed so far, semi-continuous activated sludge and river water die-away.

The Decay of Aroclors 1221, 1242, 1248 and 1254 in Natural Waters

Experimental

A five gallon supply of natural water was obtained from the Meramec River, and after allowing the sediment to settle for two days, the water was decanted into another container, remixed, and 200 ml alequots placed in 8 sets (8 bottles/set) of 160z wide mouth bottles. Four sets of the bottles were then spiked with 250 ppb of the Aroclor to be tested by injecting 0.5 ul of a 10% (w/v) solution in ethanol and 4 ppm of LAS reference #2 (Dodecene-1) added as an internal standard. After swirling to mix,the bottles were then loosely covered with foil and placed in a cardboard box. Duplicate Aroclor distilled water controls were prepared with no LAS as were river water and distilled water controls containing LAS but no Aroclor. Three other sets were also prepared, one containing Aroclor 1242 (250 ppb) and no LAS and two containing 2.5 ppm Aroclors 1221 and 1242 (no ethanol) and LAS. All the solutions were likewise covered with foil and stored in a cardboard box.

One bottle from each set was then analyzed on a weekly basis. The analysis consisted of extracting the bottle and contents with three 50 ml portions of hexane, diluting or concentrating the combined extracts to the appropriate volume and measuring the residual Aroclor by electron capture gas chromatography. Additionally the LAS was monitored by methylene blue chloroform extraction method.

Discussion

The results of the EC/GC analysis of all samples are shown in Table I. Normalized Figure I is a composite of the EC chromatograms for the Aroclor 1221 river water and distilled water exposures. Figures II-XX are the EC chromatograms of the other Aroclors after 0 and 5 weeks exposure.

Sample numbers 8 and 12 were not analyzed since the Aroclor which was

added neat could be observed as a droplet in the bottom of the bottle throughout the duration of the experiment.

Of the four Aroclors studied, Aroclor 1221 was the only one that decreased in concentration in both the river water and distilled water expoures during the five week experiment. All others remained constant definitely did not display any trend. The rate of decrease of Aroclor 1221 was greater than that of the distilled water control and accompanied by a sharp change in the isomer distribution (EC.GC fingerprint).

Conclusions

Approximately 27% of the decrease Aroclor 1221 concentration could be attributed to bacterial degradation. Another 62% is presently unaccounted for except by attributing its disappearance to non-bacterial routes such as co-volatilization, adsorption, etc.

Aroclors 1242, 1248, and 1254 showed no evidence of bacterial degradation under the conditions of this experiment.

Assuming that a plant using Aroclor 1221 is operating 7 days a week, 24 hours a day, one can calculate an allowable discharge level to water with the same overall total degradation capacity.

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TABLE 1

ppb Aroclor

SAMPLE No.	WEEKS	0	1	3	5	8
1	Control, RW, + LAS	—	—	—	—	—
2	Aroclor 1221, RW, + LAS	296	121	77	28	—*
3	" 1242, " , + "	228	209	221	209	—*
4	" 1248, " , + "	208	220	225	275	—*
5	" 1254, " , + "	188	200	200	200	—*
6	" 1242, RW	290	220	221	180	—*
7	" 1242, DW	219	213	210	194	—*
8	" 1242 (NEAT), RW, + LAS	1.875	NA	NA	NA	NA
9	" 1221, DW	269	167	152	101	—
10	" 1248, DW	215	213	213	163	—*
11	" 1254, DW	167	168	170	180	—*
12	" 1221 (NEAT), RW, + LAS	NA	NA	NA	NA	NA
13	Control, DW, + LAS	—	—	—	—	—

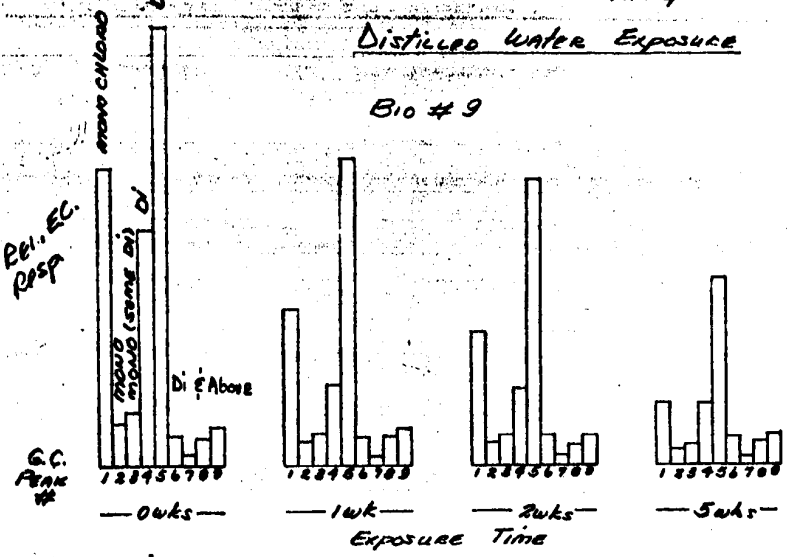
DW - distilled water
RW - river "
LAS - Linear alkylbenzene sulfonate
Dodecene - 1

* Results discarded, blank contaminated with Aroclor 1242

NA - Not Analyzed

MONS 067827

Aroclor 1221 River Water Biodegradation Study



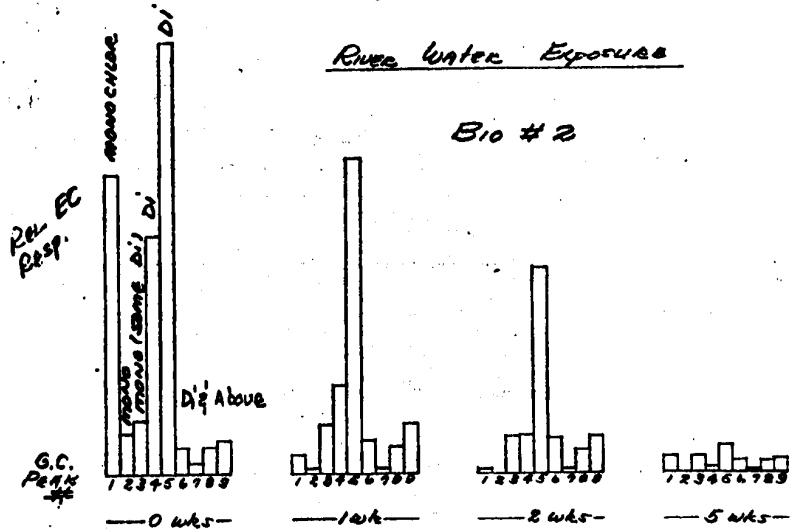


FIGURE I

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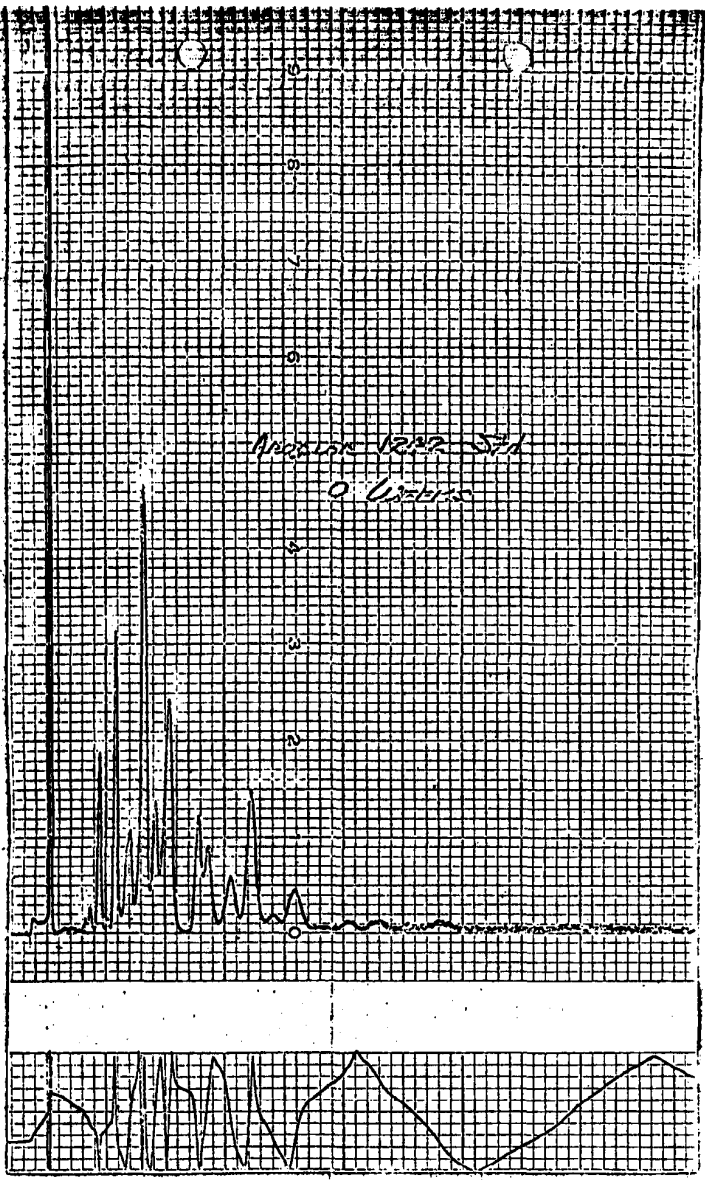

FIGURE II

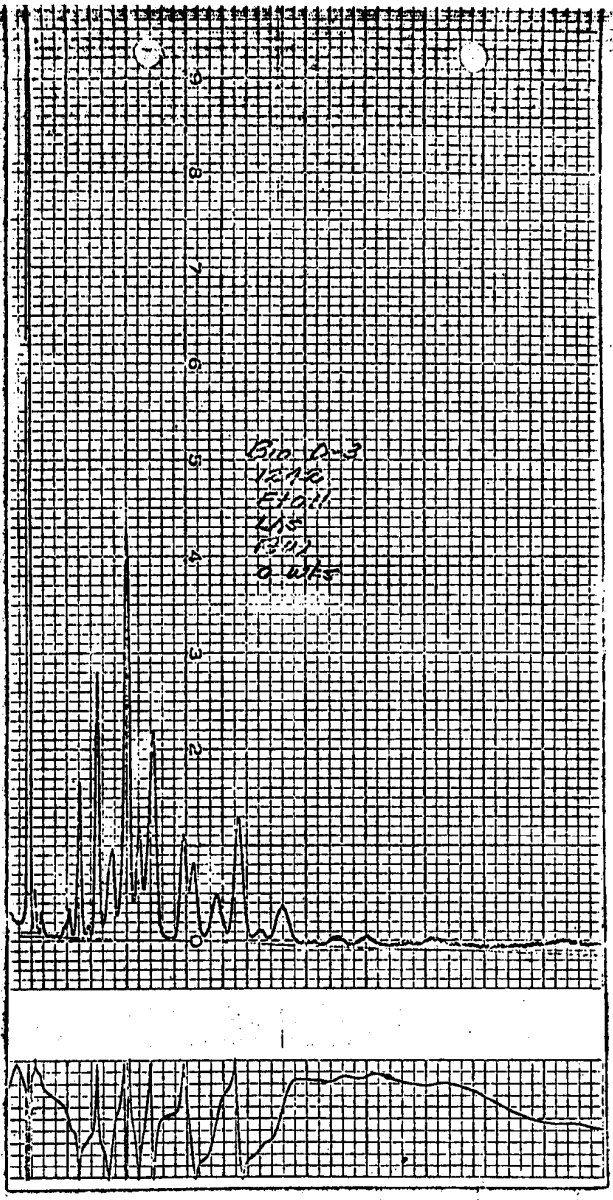

Figure III

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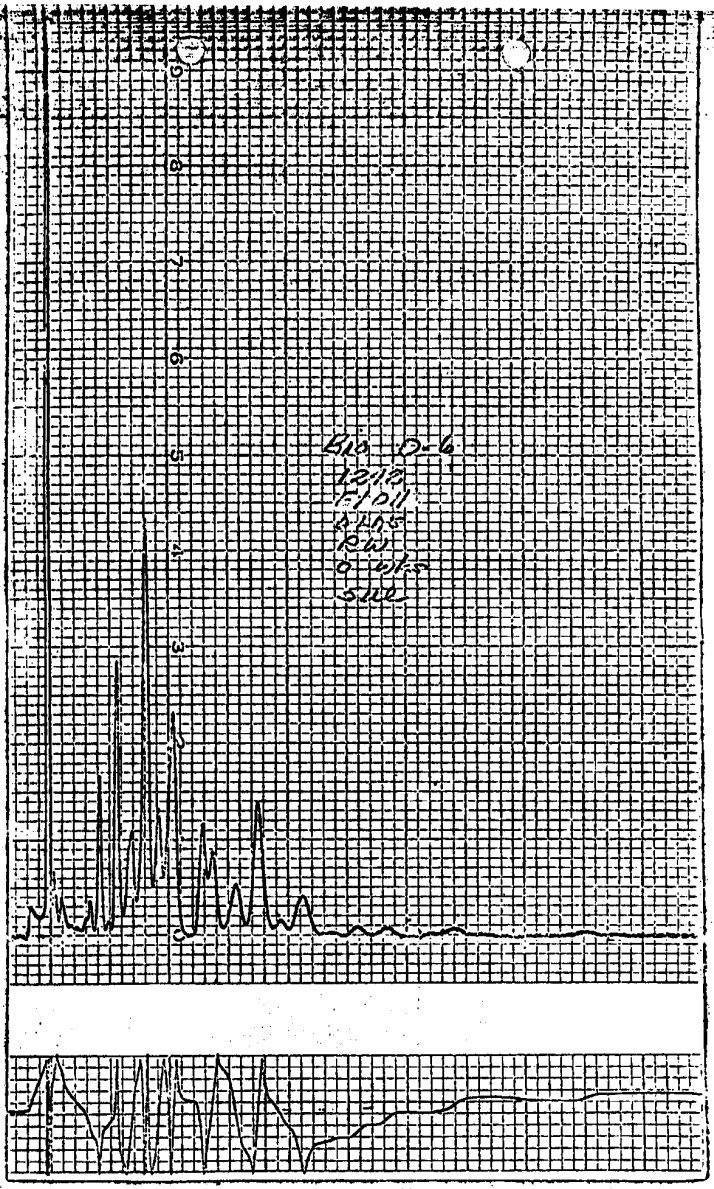
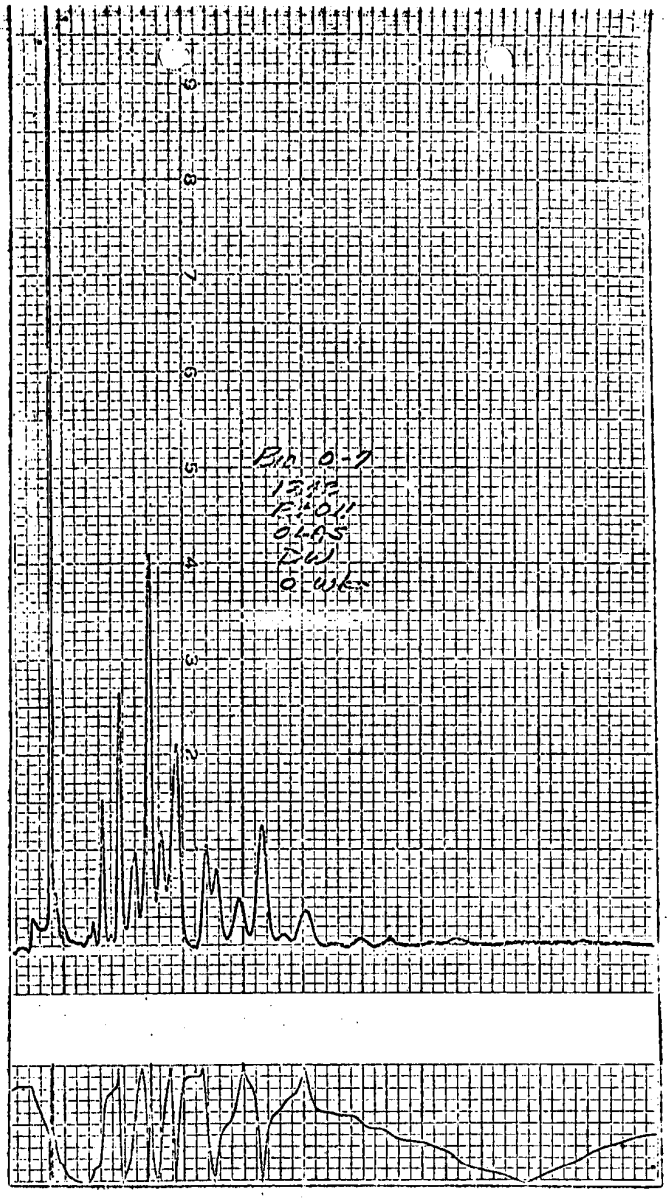


FIGURE IV



FIGUEE V

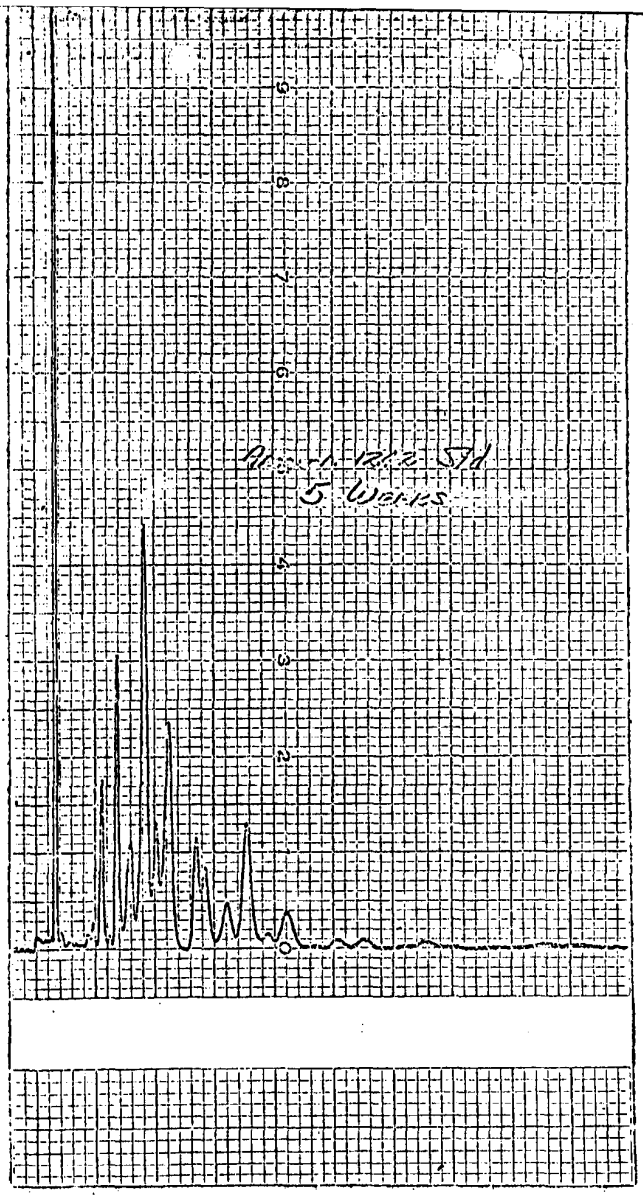


FIGURE VI

MONS 067833

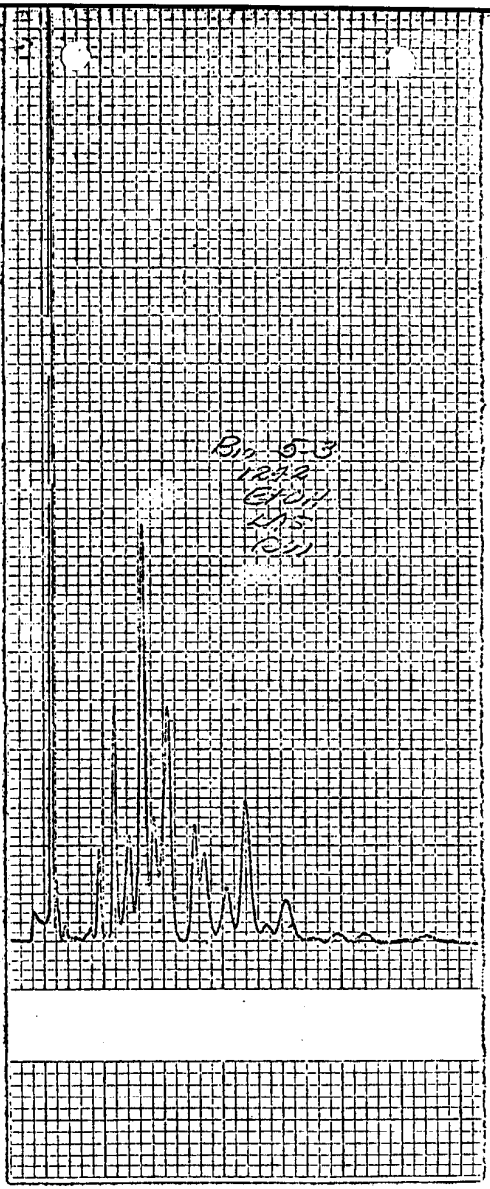


FIGURE VII

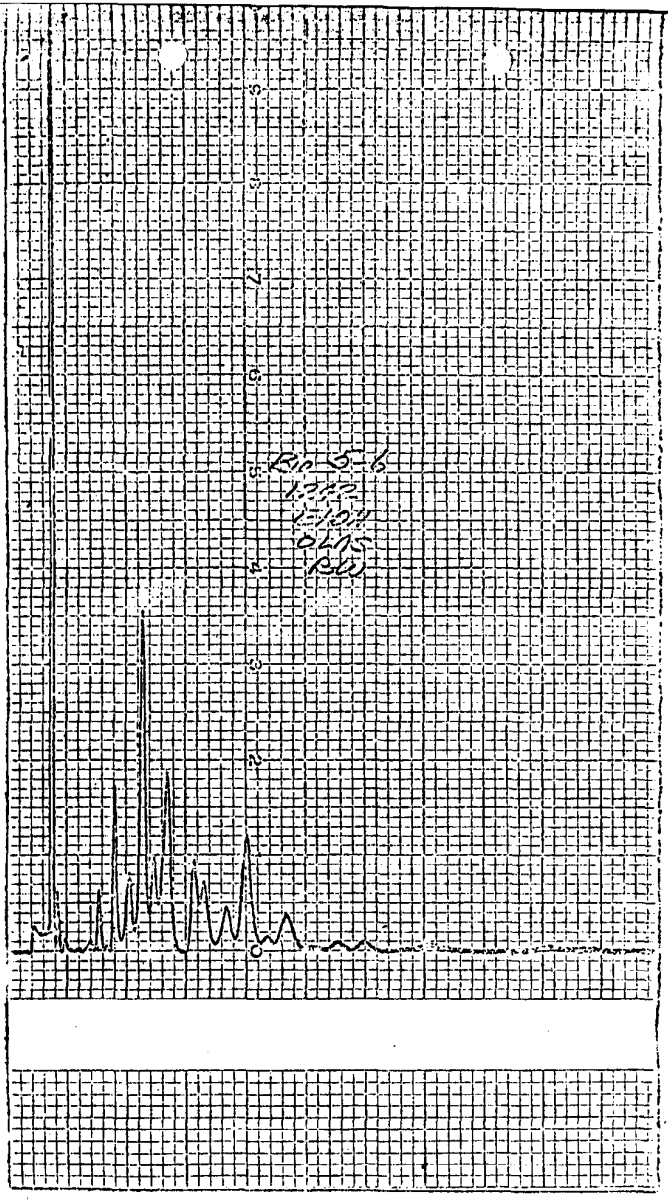


FIGURE VIII

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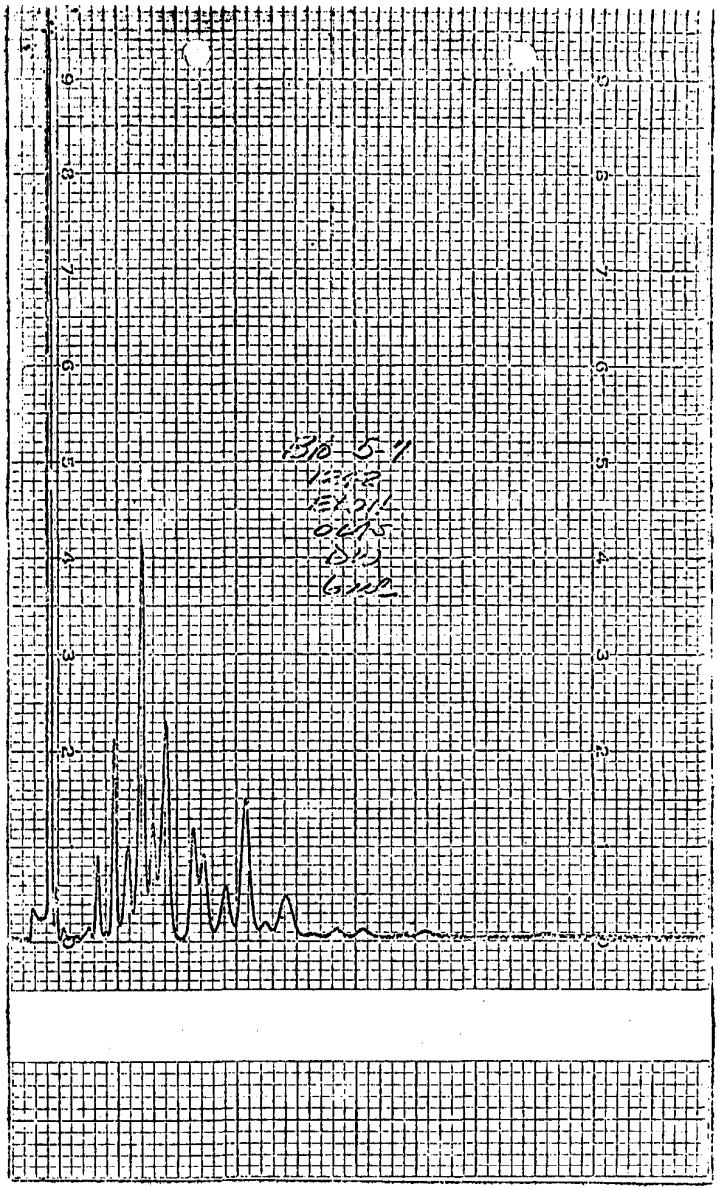

Figure IX

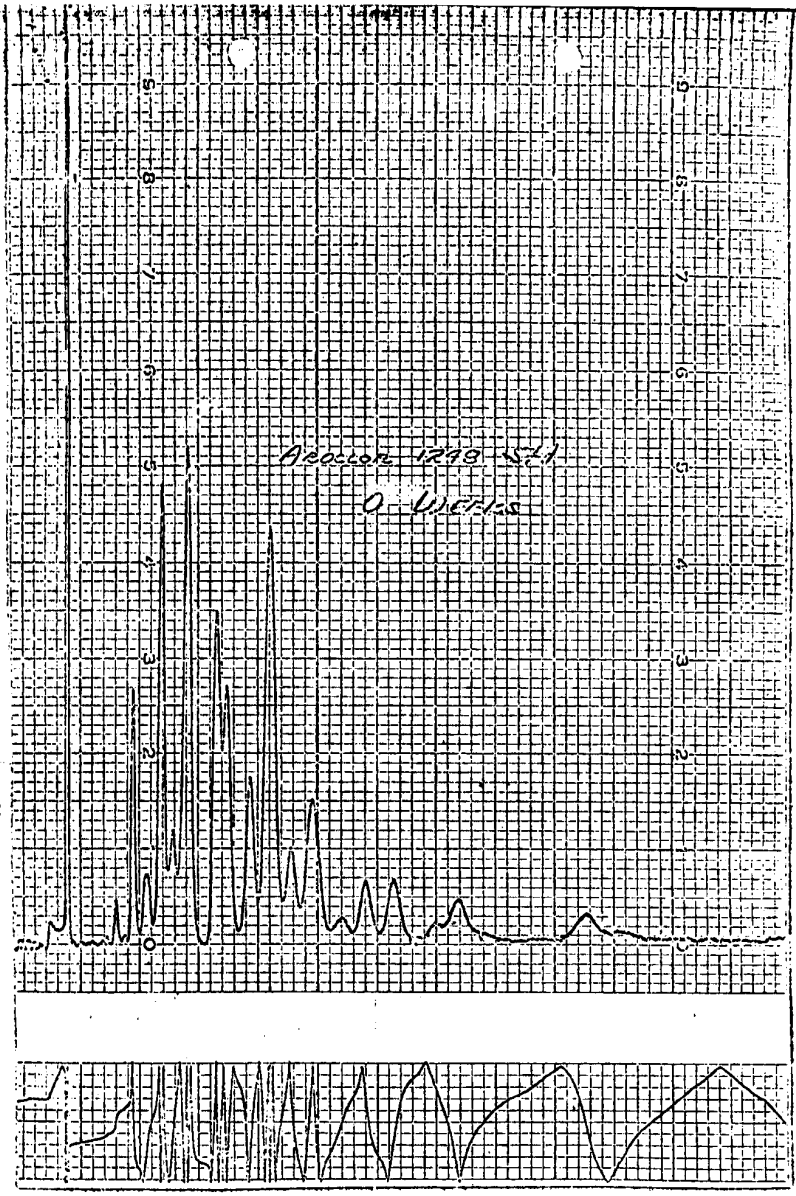

FIGURE X

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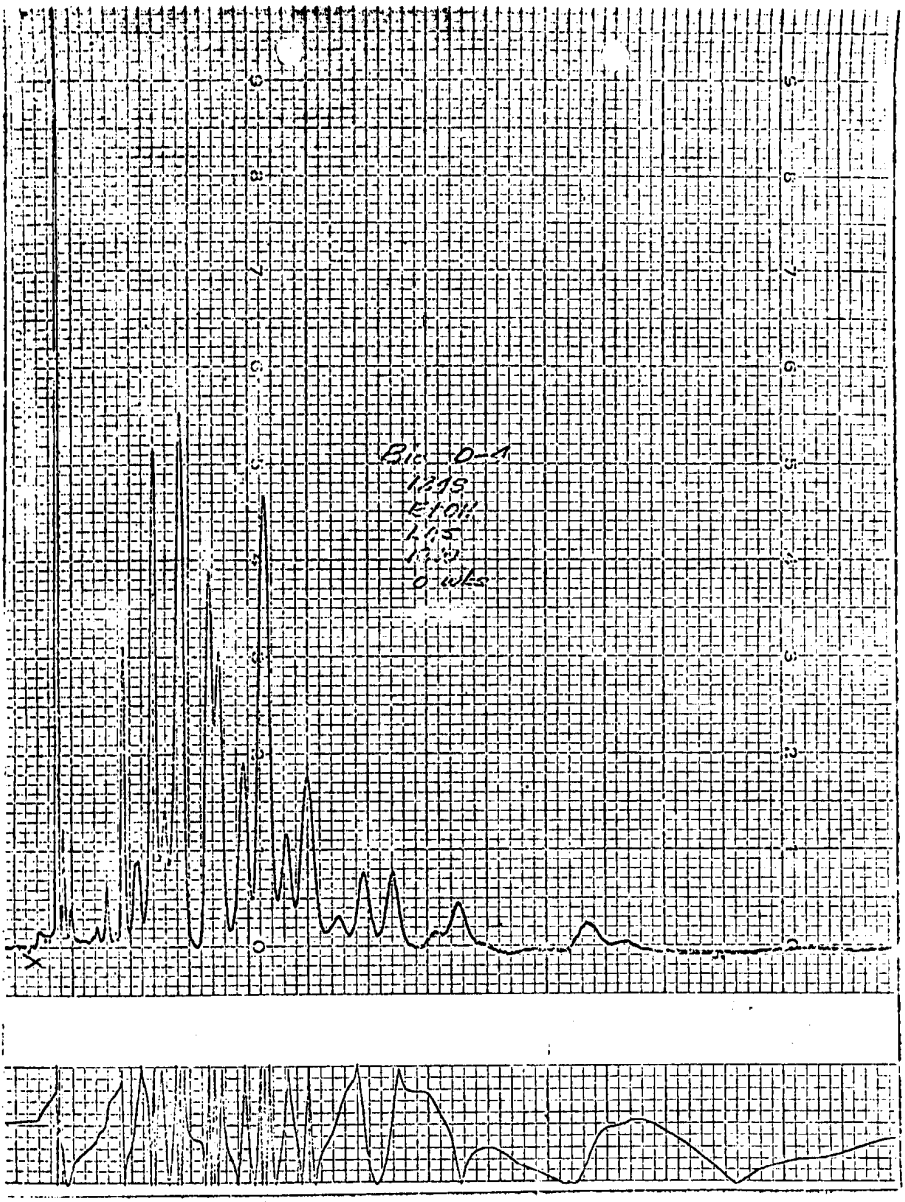

FIGURE XI

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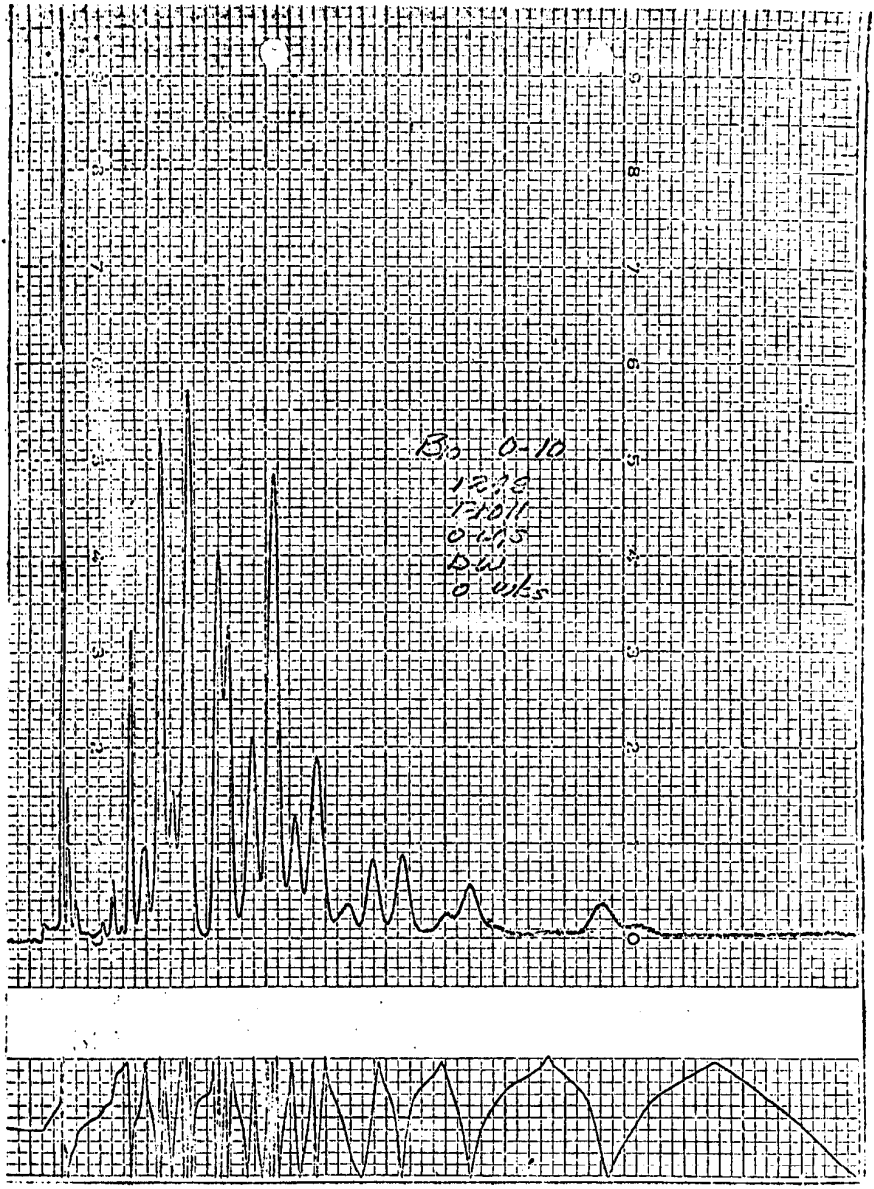

Figure XII

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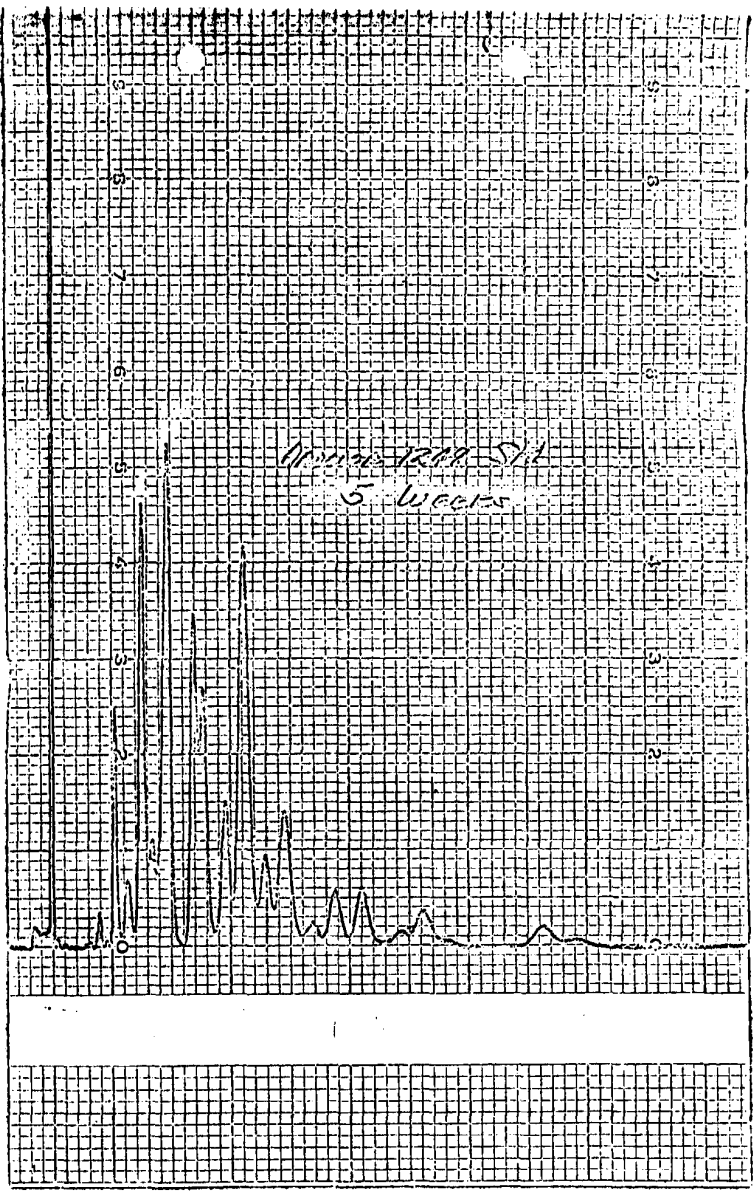

FIGURE XIII

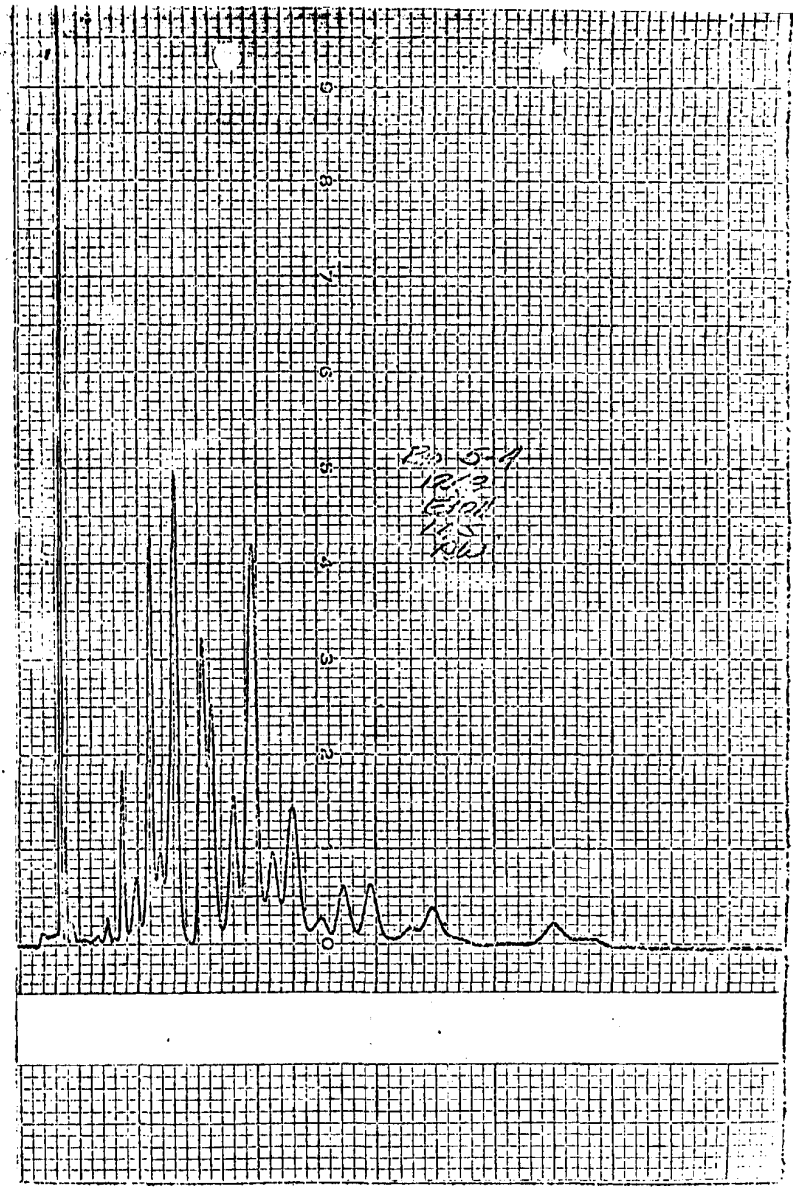

FIGURE XIV

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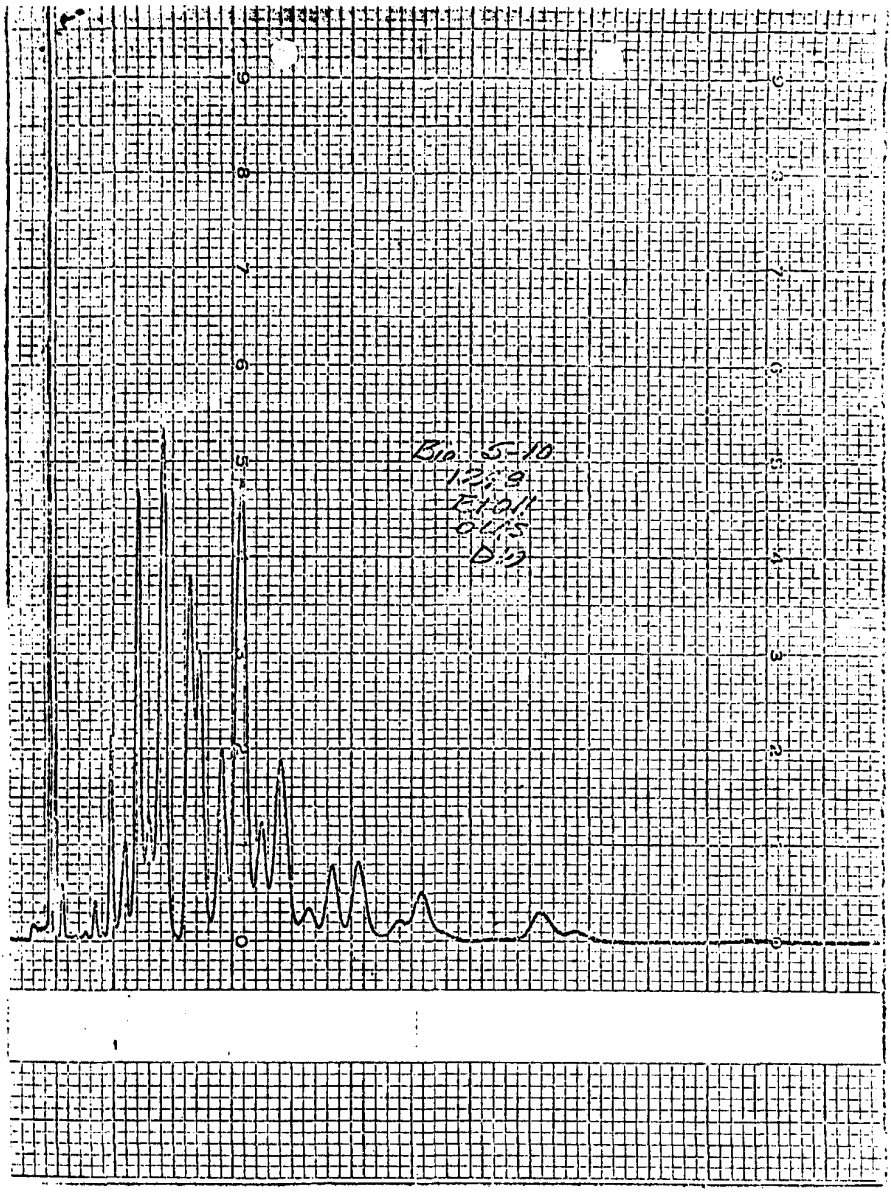

FIGURE XV

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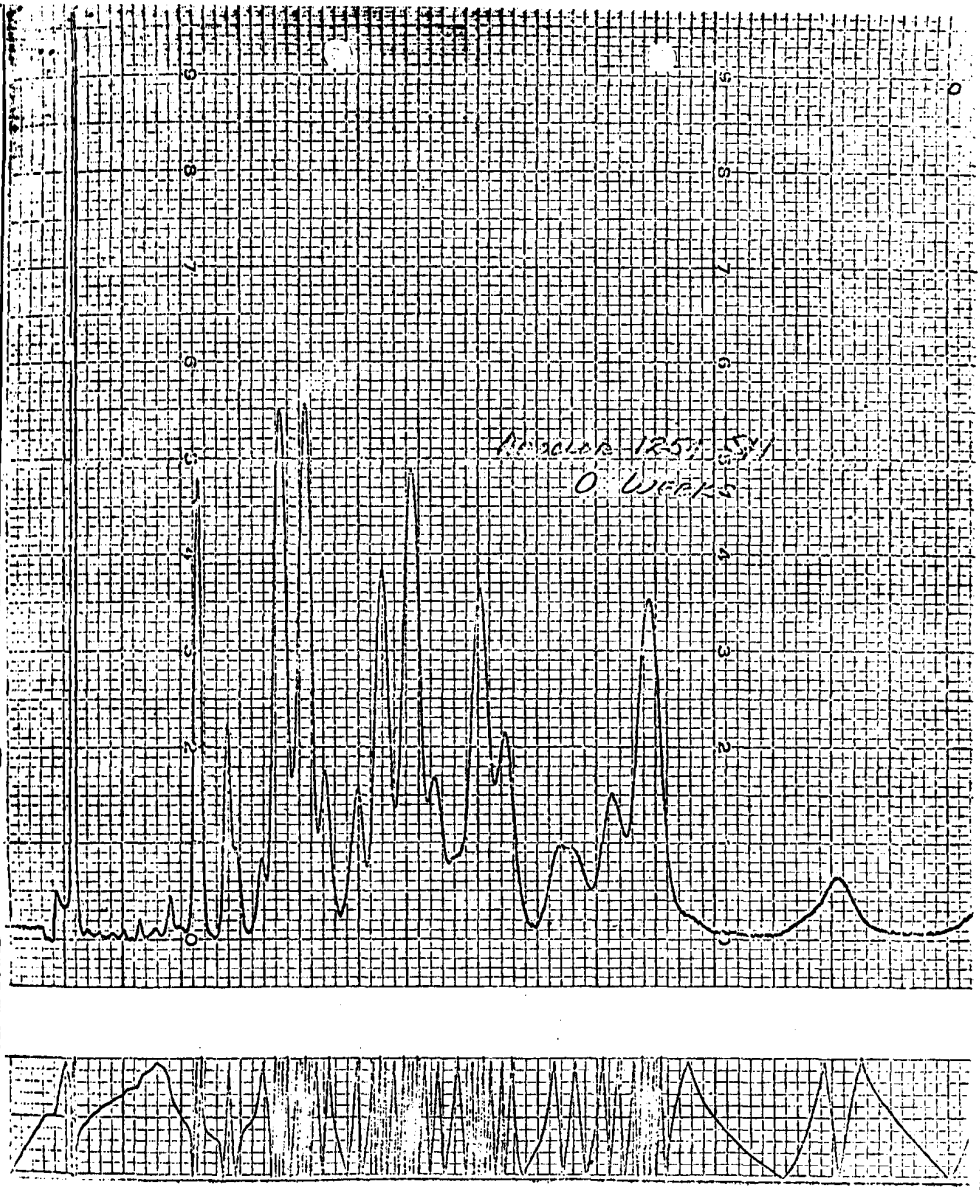

FIGURE XVI

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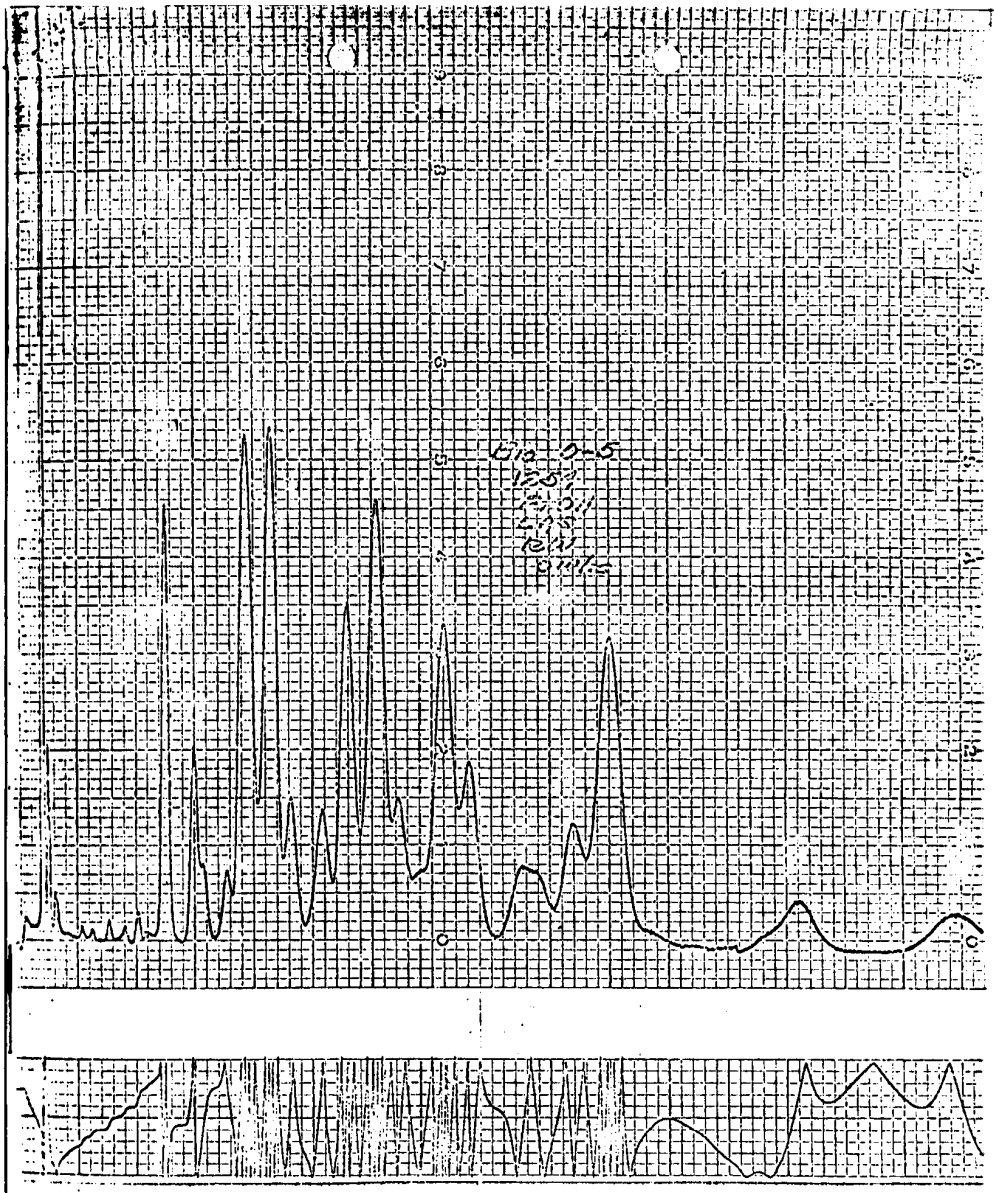

FIGURE XVII

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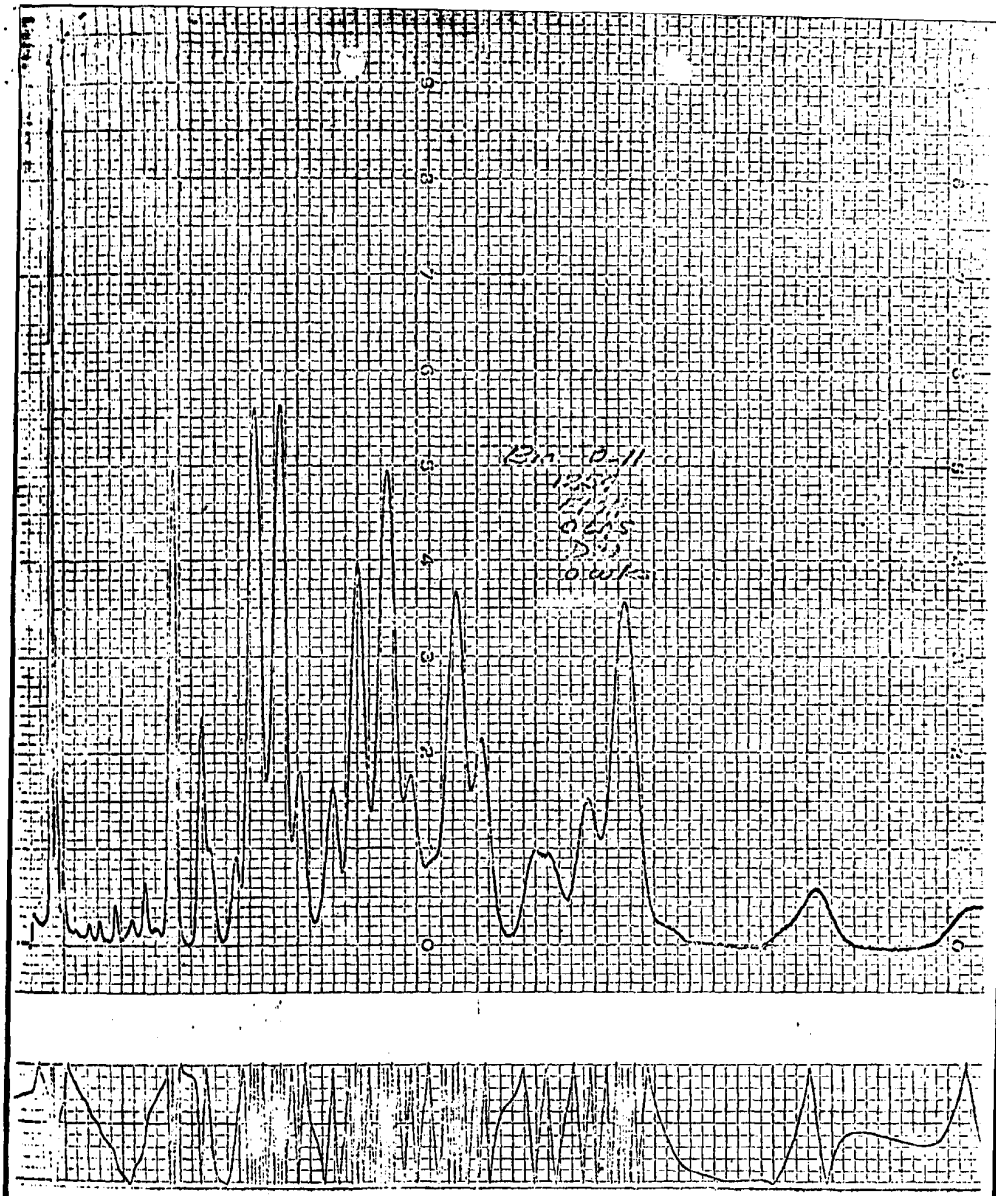

FIGURE XVIII

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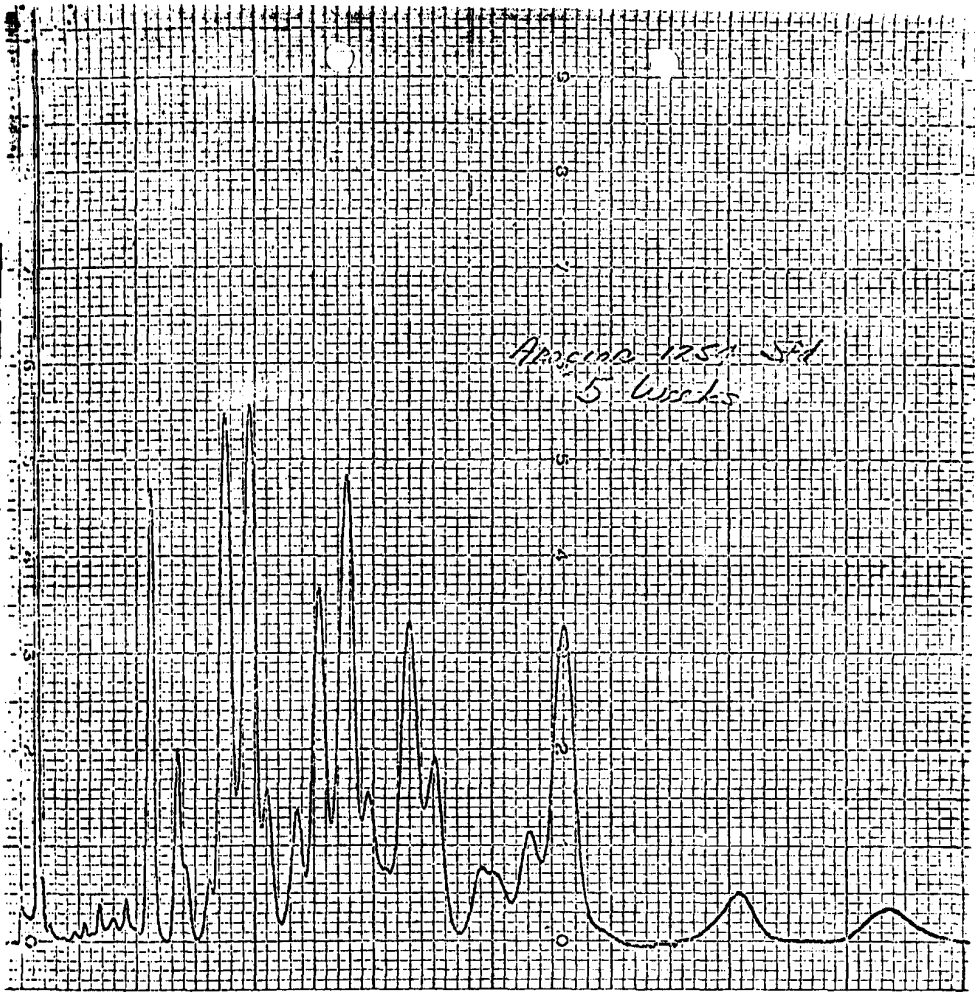

FIGURE XIX

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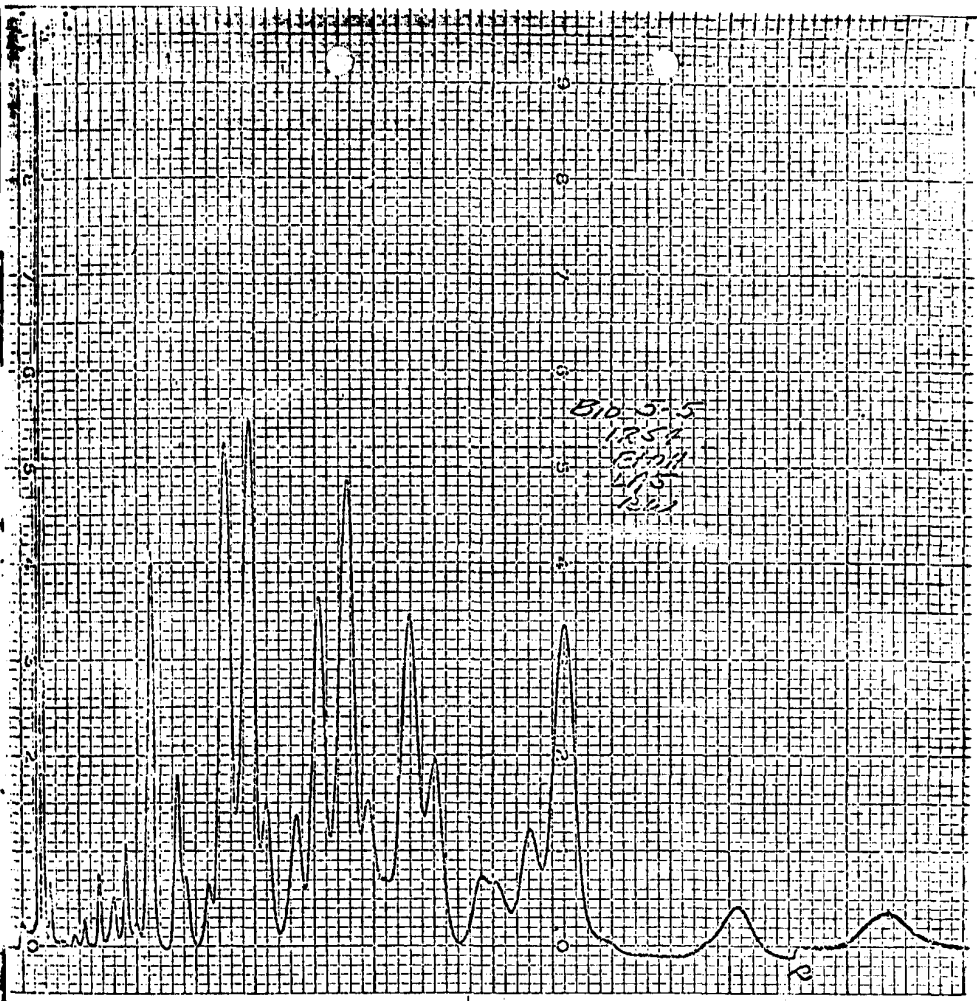

FIGURE XIX

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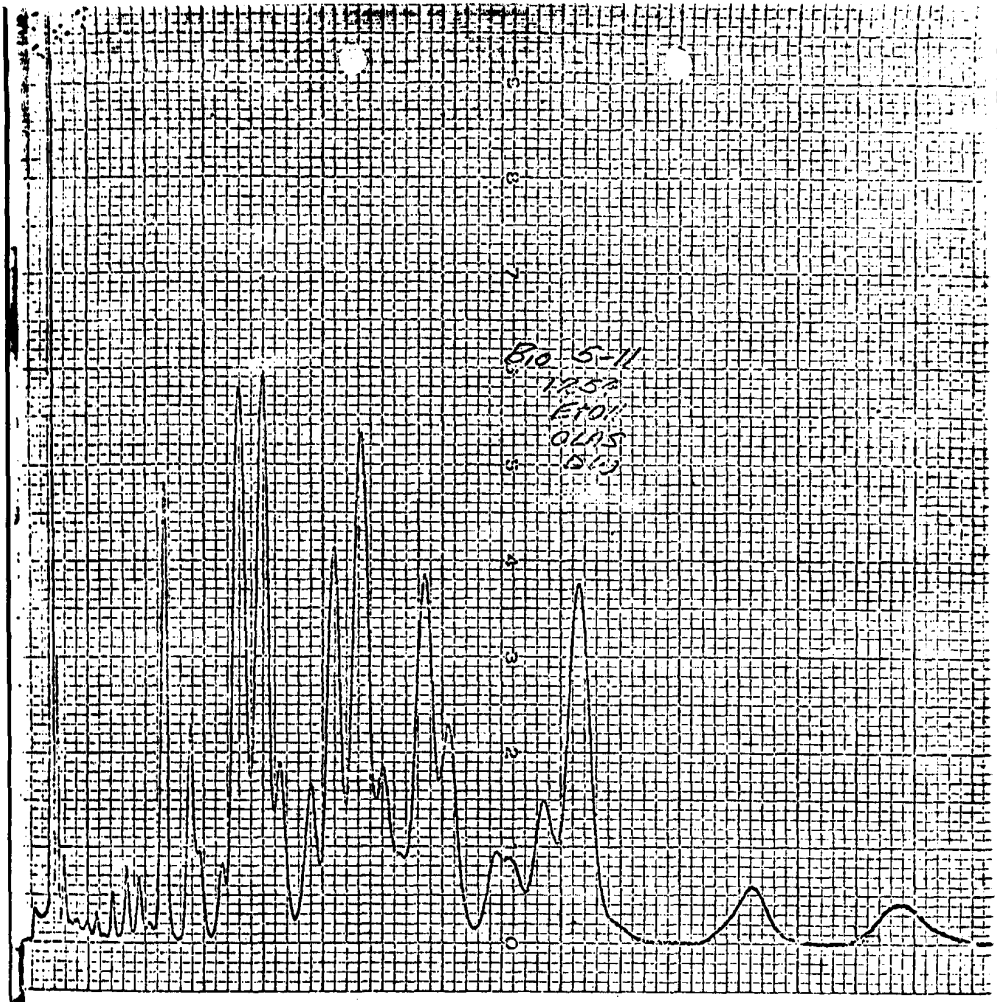

FIGURE XX

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