APPARENT MOLECULAR WEIGHT DISTRIBUTION IN RAW AND TREATED WASTEWATERS

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Molof and Zuckerman have placed considerable emphasis on the chromatographic data developed in their work. Based upon these data, they have posited the following contentions, which are basic to the proposed hydrolysis-adsorption process:

1. Activated sludge effluents consist solely of organic compounds with apparent molecular weights greater than 1200.

2. Activated carbon adsorption preferentially removes organic compounds of low molecular weight (less than 400).

Since June 1968 personnel of the Bio-Environmental Engineering Division have been involved in a study of the stimulatory effects of wastewater organics on the growth of algae. To this end using gel permeation chromatographic techniques, the organic material extant in selected wastewaters have been fractionated. All fractionations were performed on 2.5x100 cm. columns (Sephadex, K 25/100). Data developed in our laboratories, using the above technique bear out neither of the above contentions. With regard to the first point, we have subjected a concentrated sample of wastewater effluent from a conventional activated sludge system located at Batavia, New York, to fractionation on Sephadex G-10. Figure 1 depicts a typical chromatogram developed from this sample. The data indicate that approximately 60% of soluble organic material (less than 0.45 microns) produced by an activated sludge system has an apparent molecular weight (A.M.W.) of less than 700. (Organic carbon measurements made with an infrared carbon analyzer).

The front from several G-10 runs on Batavia effluent has been composited and subjected to fractionation on a Sephadex G-25 column., The resulting data, in concert with the G-10 data, show that 76% of the organic material extant in an activated sludge effluent has an apparent molecular weight of less than 1200.

In further illustration, a trickling filter effluent, and an extended

aeration effluent have been fractionated on G-10. The percentages of organic Material possessing an apparent molecular weight of less than 700 for these samples are respectively 72% and 78%. Furthermore, a second sample of activated sludge effluent from Batavia was fractionated on G-10. This fractionation showed that 68% of the organic material had an apparent molecular weight of less than 700.

With regard to the second contention, samples of effluent from carbon columns in the Z-M pilot plant in New Rochelle, New York and a laboratory scale chemical-physical unit have also been analyzed. Figure 2 represents the chromatogram of an effluent sample from the new Rochelle facility. These samples exhibit a preponderance of low molecular weight material (less than 400), which is in contradiction with graphical presentations of chromategraphic data presented previously by Molof and Zuckerman.

Several samples of untreated wastewater from various locations have also been analyzed. Chromatograms developed have show that low molecular weight material (less than 400) again is representative of the greatest percentage of the organic material in the samples. All the chromatograms for the raw wastewater samples exhibited striking similarity in the regard. On the average, the organic material of apparent molecular weight greater than 1200 amounts to less than 10% of the organic material in the sample.

Some of the data developed above were, as noted previously, based on concentrated samples. The concentration procedure employed was freeze drying. Samples of the same wastewater, concentrated and unconcentrated, have been fractionated on G-15 and analyzed. These analyses were performed with a low level carbon analyzer utilizing a Mine Safety Appliance (MSA) Model No. 2005 Infrared Analyzer. Figure 3 depicts the resulting chromatograms. The data clearly indicate that concentration by the freeze drying method neither affects the basic character of the sample, nor leads to selective carbon losses.

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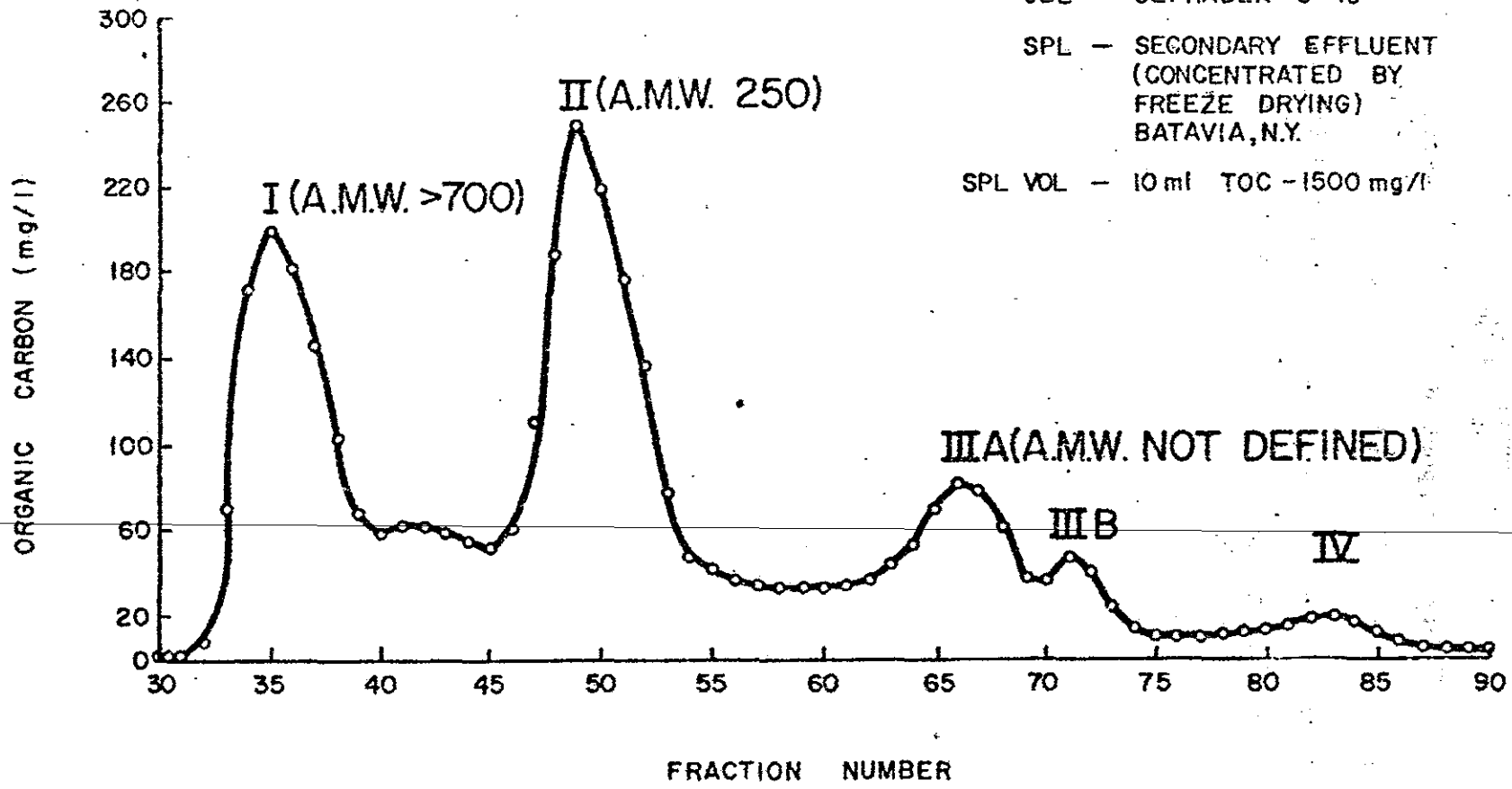

GEL — SEPHADEX G-10
SPL — SECONDARY EFFLUENT (CONCENTRATED BY FREEZE DRYING) BATAVIA, N.Y.
SPL VOL — 10 ml TOC - 1500 mg/l
I (A.M.W. >700)
II (A.M.W. 250)
IIIA (A.M.W. NOT DEFINED)
IIIB
IV
ORGANIC CARBON (mg/l)
FRACTION NUMBER
0
20
60
100
140
180
220
260
300
30
35
40
45
50
55
60
65
70
75
80
85
90

FIGURE 1

GEL — SEPHADEX G-15

SPL — CARBON COLUMN EFFLUENT (CONCENTRATED BY FREEZE DRYING)
NYSDH PILOT PLANT
NEW ROCHELLE, N.Y.

SPL VOL — 9 ml TOC — 366 mg/l

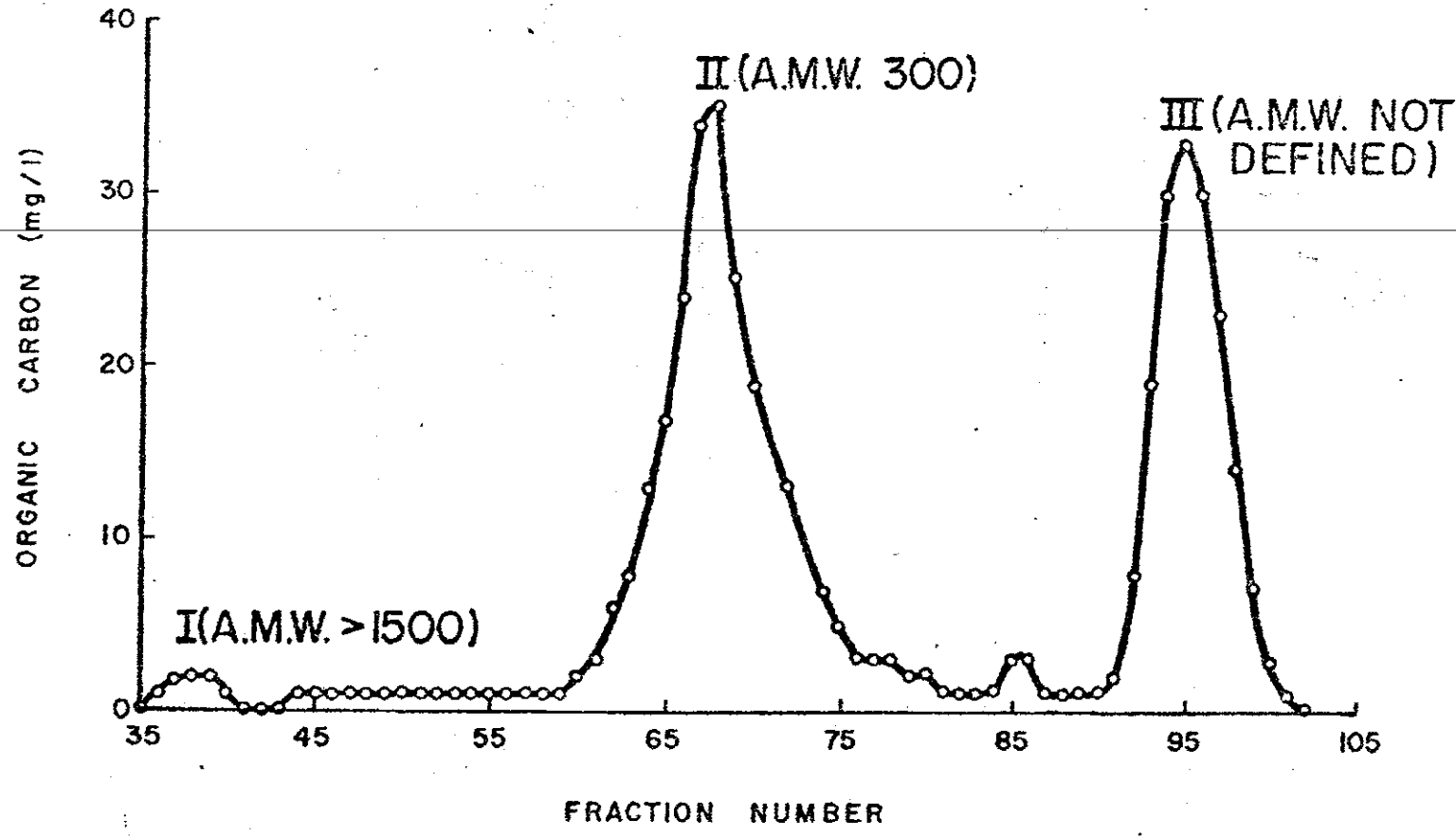
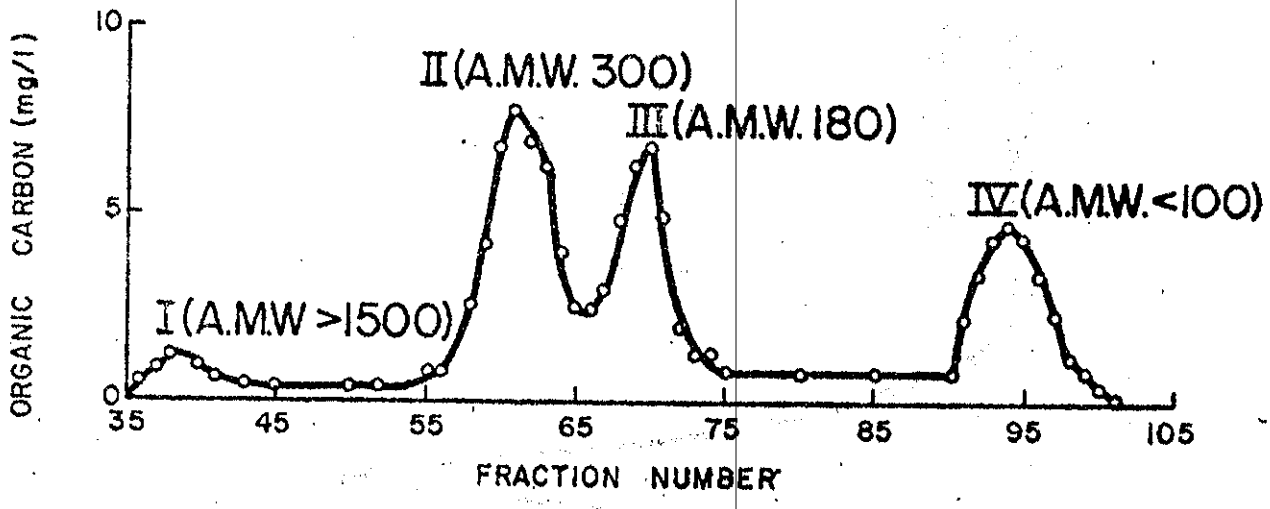


FIGURE 2

GEL – SEPHADEX G-15

SPL – RAW DOMESTIC SEWAGE (NOT CONCENTRATED) ELNORA, N.Y.

SPL VOL – 10 ml TOC – 62 mg/l



GEL – SEPHADEX G-15

SPL – RAW DOMESTIC SEWAGE (CONCENTRATED BY FREEZE DRYING) ELNORA, N.Y.

SPL VOL – 10 ml TOC – 230 mg/l

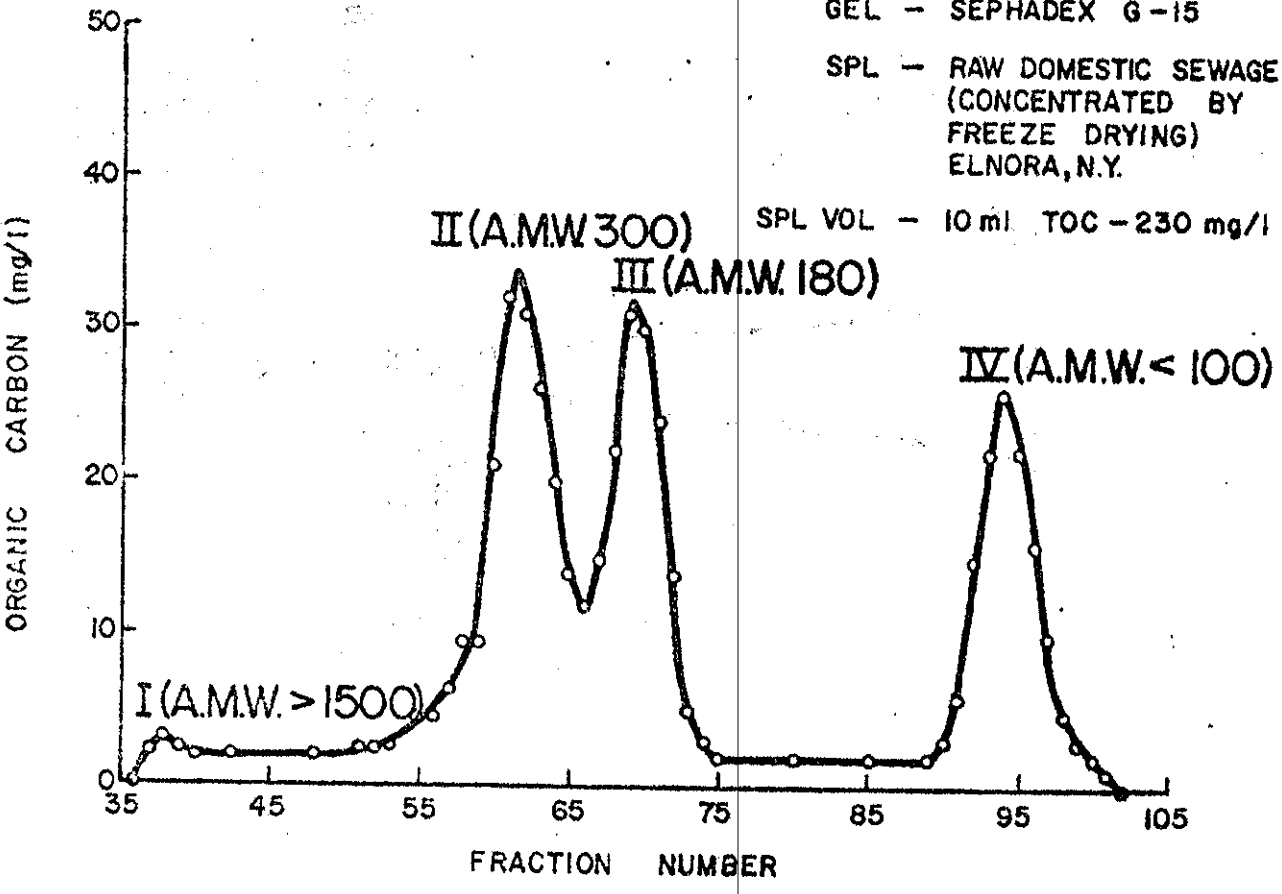


FIGURE 3