

Journal of the Arkansas Academy of Science

Volume 8

Article 11


1955

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Hoffman, Carl E. (1955) "Some Chemical Changes Resulting From Industrial Waste Disposal in the Ouachita River," *Journal of the Arkansas Academy of Science*: Vol. 8 , Article 11.

Available at: <http://scholarworks.uark.edu/jaas/vol8/iss1/11>

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SOME CHEMICAL CHANGES RESULTING FROM INDUSTRIAL WASTE DISPOSAL IN THE OUACHITA RIVER

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During the summer of 1942 the Arkansas Game and Fish Commission equipped a field party to conduct a limnological survey of the Ouachita River, Arkansas, from Camden to Lock Eight. This river has two main tributaries entering it as it flows between these two points (Figure 1). The first, the upstream tributary, is West Two Bayou which contained paper-mill wastes from the Camden Mill of the International Paper Company, and also sewage from the City of Camden. During the summer in which this investigation was carried on only "wash-water" from the paper mill was introduced into West Two Bayou. At the time of this study the paper-mill and sewage pollution had been entirely dissipated by the time the river flow reached Spoon Camp, nine miles below West Two Bayou and nine miles above Miller's Bluff. The second, the downstream tributary, is Smackover Creek which contained chlorides and oil from the Smackover oil fields. The purpose of this paper is to reveal some chemical changes in the Ouachita River brought about by the introduction of chlorides from Smackover Creek at a time of the year when river flow is at its minimum.

ACKNOWLEDGEMENTS

The author is indebted to Joe Hogan, Superintendent of Fisheries, Arkansas Game and Fish Commission, for cooperation and assistance in all phases of this investigation; to John Dawson, Stephens, Arkansas, for courtesies extended while this work was in progress.

MATERIALS AND METHODS

The water samples for chemical analyses were collected with a modified Kemmerer sampler. Chemical determinations, with the exceptions of chloride and alkalinity, were completed in the field. Chemical determinations of dissolved oxygen, free carbon dioxide, alkalinity and chloride were made in accordance with methods described in the Standard Methods of Water Analysis (1936). Hydrogen-ion concentration determination was made with a Hellige disc colorimeter.

SAMPLING STATIONS

For the purpose of determining chemical changes in the Ouachita River brought about by the introduction of chloride-polluted water from Smackover Creek, ten regular stations were chosen from Miller's Bluff to Lock Eight. These stations were all far enough downstream from Camden to be free of paper-mill and sewage pollution. Station No. 1, at Miller's Bluff, was approximately six miles above Smackover Creek. This station was established because it was above any traces of pollution from Smackover Creek. For approximate distances between stations, refer to Figure 1. Station No. 2, Roark's Ferry, was four miles above Smackover Creek. This station along with Station No. 1 represents the natural conditions of the river. Station No. 3, one-fourth mile above Smackover Creek, was selected because preliminary sampling showed that pollution extended to this distance upstream. Station No. 4, established one-fourth mile within Smackover Creek, typifies the chloride conditions in the polluted tributary. Since no other sources of pollution were found between Smackover Creek and Lock Eight, the other stations were spaced at significant intervals between these two points.

RESULTS

Table 1 is a summary of vertical chemical conditions in the Ouachita River from Miller's Bluff to Lock Eight during August, 1942. Stations No. 1 and No. 2 represent unpolluted conditions in the Ouachita River which were: a maximum chloride reading of 30 ppm., dissolved oxygen present from surface to bottom, and near uniformity in both pH and free carbon dioxide between surface and bottom levels. As the chloride-polluted water from Smackover Creek entered the Ouachita River it flowed along the bottom of the stream bed downstream and, to a limited extent, toward upstream (Table 1). At all stations showing pollution (3 through 10), the heavy salt concentrations extended from the fourth meter to the bottom.

At Stations No. 3 through No. 7 the greatest chloride concentrations were found in the water on the bottom, while in Stations No. 8 and No. 10 there was a tendency for the salt to become somewhat equally distributed between the lowest two or three meters. Increased chloride concentrations were responsible for other chemical changes such as: a decrease in dissolved oxygen, an increase in free carbon dioxide, and an increase in hydrogen ions. At all stations below Smackover Creek the water next to the bottom was oxygen free while the water in the meter above that was either oxygen free or nearly so. Methyl Orange readings (due entirely to bicarbonate) are presented in Table 1. Water surface temperatures during the month of August varied from 30.0° C to 34.0° C.

REFERENCES

1. American Public Health Association, 1936. *Standard Methods for the Examination of Water and Sewage*. Lancaster Press, Inc., Pa., 8, pp. 1-309.

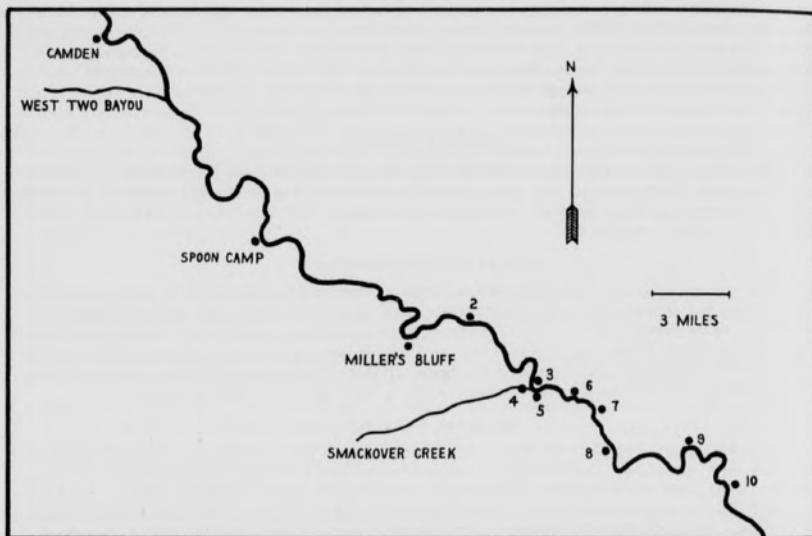


Figure 1. The Ouachita River from Camden to Lock Eight with location points and sampling stations.

Explanation of Figure 1. Location points and sampling stations along the Ouachita River with approximate distances above and below Smackover Creek.

Stations	Location Points		Mileage from Smackover Creek
	Camden	UPSTREAM	27.00
	West Two Bayou		24.00
	Spoon Camp		15.00
1	Miller's Bluff		6.00
2	Roark's Ferry		4.00
3	1/4 mile above Smackover Creek		0.25
4	1/4 mile within Smackover Creek (Mouth of Creek)		0.00
		DOWNSTREAM	
5	1/4 mile below Smackover Creek		0.25
6	2 miles below Smackover Creek		2.00
7	3 miles below Smackover Creek		3.00
8	Calion		5.00
9	Gas Line crossing		9.00
10	Lock Eight		12.00

CHEMICAL CHANGES FROM INDUSTRIAL WASTE DISPOSAL

Table 1. Chemical conditions in the Ouachita River from Miller's Bluff to Lock Eight during August 1942.

Station	Depth in Meters	Chloride ppm.	Oxygen ppm.	Free CO ₂ ppm.	M. O. Alkalinity ppm.	pH	
1 *	0.0	24.0	3.7	6.0	43.0	6.5	
	9.0	30.0	3.7	8.0	41.0	6.5	
2 *	0.0	24.0	4.0	3.0	46.0	6.5	
	6.0	30.0	2.7	4.5	22.0	6.6	
3 *	0.0	120.0	4.8	3.0	39.0	6.6	
	1.0	120.0	4.8	- -	- -	- -	
	2.0	120.0	3.8	5.0	38.0	- -	
	3.0	120.0	3.7	- -	- -	- -	
	4.0	4,200.0	2.6	9.0	39.0	6.5	
	5.0	8,400.0	2.0	- -	- -	- -	
	6.0	10,400.0	0.9	30.0	44.0	6.3	
4	7.0	12,400.0	0.9	31.0	46.0	6.3	
	0.0	3,500.0	2.4	6.0	- -	6.5	
	4.0	10,500.0	0.0	18.0	- -	6.3	
	5 **	0.0	66.0	4.4	4.3	40.0	6.6
		1.0	58.0	3.7	4.0	40.0	- -
		2.0	60.0	3.3	- -	40.0	- -
		3.0	70.0	3.5	- -	40.0	- -
4.0		2,660.0	2.9	10.0	34.0	6.5	
5.0		7,100.0	0.9	- -	34.0	- -	
6.0		9,900.0	0.0	- -	36.0	- -	
6 **	7.0	11,900.0	0.0	31.0	52.0	6.4	
	0.0	86.0	- -	3.0	42.0	6.5	
	2.0	94.0	3.8	- -	40.0	- -	
	3.0	100.0	3.7	6.0	38.0	6.4	
	4.0	6,780.0	2.9	- -	36.0	- -	
	5.0	9,000.0	0.9	- -	32.0	- -	
	6.0	9,600.0	0.0	- -	36.0	- -	
7 **	7.0	10,200.0	0.0	25.0	42.0	6.3	
	0.0	84.0	4.0	4.5	46.0	6.5	
	1.0	202.0	4.1	- -	38.0	- -	
	2.0	88.0	4.0	- -	36.0	- -	
	3.0	92.0	3.7	5.0	42.0	6.4	
	4.0	2,700.0	2.1	- -	34.0	- -	
	5.0	7,900.0	0.3	- -	36.0	- -	
8 **	6.0	10,400.0	0.0	25.0	50.0	6.3	
	0.0	98.0	4.4	4.0	46.0	6.6	
	1.0	140.0	4.1	- -	42.0	- -	
	2.0	132.0	4.0	- -	34.0	- -	
	3.0	134.0	3.7	4.0	34.0	6.5	
	4.0	2,740.0	2.3	- -	42.0	- -	
	5.0	9,500.0	0.0	- -	42.0	- -	
9 **	6.0	9,300.0	0.0	25.0	58.0	6.4	
	0.0	180.0	5.1	3.0	36.0	6.6	
	1.0	260.0	4.5	- -	36.0	- -	
	2.0	360.0	4.2	3.0	44.0	- -	
	3.0	320.0	4.2	- -	40.0	6.4	
	4.0	2,740.0	2.0	9.0	40.0	- -	
	5.0	6,100.0	0.2	- -	42.0	- -	
6.0	6,700.0	0.0	27.0	48.0	6.3		

Table 1, continued

Station	Depth in Meters	Chloride ppm.	Oxygen ppm.	Free CO ₂ ppm.	M. O. Alkalinity ppm.	pH
10 **	0.0	340.0	4.8	3.0	40.0	6.6
	1.0	860.0	4.8	- -	48.0	- -
	2.0	860.0	4.8	- -	42.0	- -
	3.0	900.0	4.7	3.5	48.0	6.5
	4.0	1,100.0	2.9	- -	40.0	- -
	5.0	6,700.0	0.4	13.0	44.0	- -
	6.0	7,500.0	0.0	- -	50.0	- -
	7.0	7,600.0	0.0	25.0	56.0	6.4

* Upstream from Smackover Creek

** Downstream from Smackover Creek