

ANALYSIS OF WATER CONTAINING ALUMINUM SALTS
AND FREE SULPHURIC ACID FROM AN
INDIANA COAL MINE.

S. D. CONNER.

Within the past year the writer was called upon to test some drainage water from a coal mine for the Vandalia Coal Company of Terre Haute with a view of determining whether such water could be used for irrigation purposes.

A qualitative examination indicated only a trace of chlorides and nitrates, but an abundance of sulphates.

The following substances were quantitatively estimated:

$\text{Al}_2(\text{SO}_4)_3$016 per cent.
CaSO_4141 per cent.
MgSO_4074 per cent.
Free H_2SO_4005 per cent.

Total solids..... .42 per cent.

Contrary to expectations, no soluble iron was found, although a slight flocculent precipitate of iron (probably basic ferric sulphate) was noted in the bottom of the bottle, indicating that originally some iron had been in solution.

In the mining of coal more or less iron pyrites (FeS_2) is exposed to the air. This pyrites in the presence of oxygen and moisture is oxidized, forming ferrous sulphate and sulphuric acid. The sulphuric acid coming in contact with clay, shale, etc., would dissolve calcium, magnesium, aluminum and other basic elements which might be present. Upon continued exposure to air the ferrous sulphate (FeSO_4) in solution would be oxidized to basic ferric sulphate ($\text{Fe}(\text{OH})\text{SO}_4$) and precipitated.

Water such as the writer analyzed is acid in reaction, due to the presence of free sulphuric acid and also to the hydrolysis of the aluminum sulphate. Such water would be injurious to vegetation and consequently unfit for irrigation purposes.

The presence of soluble aluminum instead of soluble iron is a condition similar to that found in the acid soil of the Wanatah experiment field in Laporte county (as reported by Abbott, Conner and Smalley in Bul. 170 of the Ind. Exp. Station).

There is little danger of soluble salts of iron being present in well-drained and aerated soils or in irrigation water which has been exposed to the air for any length of time. This is due to the fact that soluble salts of iron readily oxidize and are precipitated on exposure to air. Soluble salts of aluminum are not readily precipitated and there is danger of these being present in injurious amount in acid soils either drained or undrained and in mine waters.

On the Wanatah field it was necessary to apply some form of lime to neutralize the acidity before crops could be grown. It was also found that aluminum nitrate was just as injurious to corn grown in water cultures as was an equivalent amount of nitric acid. It would undoubtedly be necessary to neutralize the acidity of the coal mine water with some form of lime before it could be utilized for irrigation purposes.