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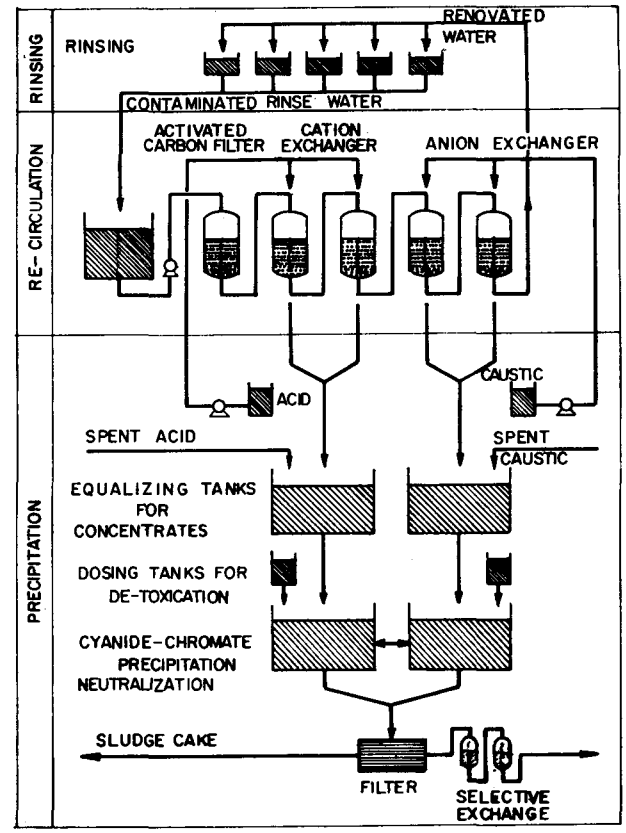

Fig. 9—Rinse waterr enovation by ion-exchange in a metal-finishing plant.

Discussion

Dr C. M. van Staden (Fellow): Mr President, ladies and gentlemen, thank you very much for this opportunity to contribute to the paper by Dr Stander, and Messrs Henzen and Funke.

First of all, my congratulations to Dr Stander on being re-elected President of the International Association of Water Pollution Research. We in South Africa are proud that this honour was again bestowed on our leading scientist in the field of water research. Furthermore, my congratulations to the authors of this paper.

The growth of the pollution problem caused by acidic water discharged from abandoned collieries, is known to most of us. However, I am not aware of any case where an abandoned gold mine is directly discharging polluted underground water. I think it is also a debatable point as to what the quality of underground water being discharged from abandoned gold mines would be in the long run. Any reduction works on a gold mine which practises only fairly good housekeeping, should not cause any water pollution by cyanide.

First of all, any cyanide solution before gold precipitation would be too valuable to lose. Secondly, the precipitated solution, which contains the cyanide, is used to pump slime to slimes dams. Any cyanide pollution that may occur at the slimes dam, must come from the top and, fortunately, the days when penstock water was discharged directly from the top of dams into public streams, have gone. Run-off and seepage is usually acidic, thus decomposing the cyanide.

The code of practice by the Chamber of Mines is quite clear on the point as to how the tops of dams should be secured, to prevent any process water or storm-water polluting public streams. The general standards are given on page three of the paper.

To my knowledge, under certain circumstances a degree of relaxation can be given regarding the faecal coli count; namely a permissible count of 1 000 per 100 ml. I feel very strongly that research aimed at inhibiting the activity of acid-producing bacteria should be encouraged. Success in this field would be of great benefit to the mining industry.

I am very thankful that the authors have mentioned vegetation of dumps as a method to combat water pollution, with the full awareness that the key objective in vegetating dumps is to prevent air pollution. A problem that I have not heard mentioned before and on which I would appreciate the views of the authors, is the pollution that may be caused by power-stations discharging

fluorides through chimney stacks. Komati, Camden, Hendrina, Arnot and Kriel at full load, will be burning coal at the rate of about 23.5 million metric tons per annum, containing an average of 188 parts per million fluorine, of which 90 per cent is volatilised; that is about 11 metric tons of fluorine per day. This could contaminate 2 400-million gallons of water per day to a level of one mgm fluorine per litre, whereas 25-million gallons of underground water on the Witwatersrand, at 3 500 mgm per litre TDS will contaminate only 175-million gallons of water to a level of 500 mgm TDS per litre. The possible pollution that may be caused by boron present in the coal will not be dealt with.

Thank you very much, Dr Stander and co-authors, for the stimulating paper you have presented.

A. B. C. Daneel (Fellow): Mr President, gentlemen, may I associate myself with the congratulatory remarks which Dr van Staden made about Dr Stander's re-appointment as President of the International Association of Water Pollution Research.

I would like to make a few brief observations to clarify one or two matters which are mentioned in the paper. First of all, I think it will be agreed that there is no known economic method of removing dissolved solids from effluents. The spotlight has been on the area of the Witwatersrand which drains into the Vaal Barrage but, with the decrease of mining in this area and hence pumping of underground water, pollution from this source is decreasing.

Various proposals have been put forward to reduce dissolved solid concentrations in the Barrage waters until such time as the problem of the mine effluent load decreases to non-troublesome proportions. It has been suggested that mine effluent should be pumped or gravitated to natural pans or man-made dams, where these waters could be evaporated or used for other purposes. When considering such schemes which may be costly, it should be borne in mind that, within less than ten years, only one mine in this area would be pumping any appreciable quantity of water. Dr Stander mentioned in his paper that in 1957 an average of 37 mgd was being pumped from Central and East Rand mines. At present this quantity is 22 mgd and, as mentioned earlier, within ten years there will only be one mine pumping water.

One may ask what will happen to all the water which was pumped previously? It should be made clear that the Witwatersrand mines are unlikely to be a source of continuing pollution, once they have closed down. Unlike certain collieries where outcrop workings constitute a continued source of drainage, gold mines will fill up to watertable level and further outflow will cease. This should reduce by two-thirds pollution from mining sources referred to in the paper.

The work of securing mine dumps to reduce run-off is proceeding as mentioned by the authors. I would like to add that, by 1980, we estimate that the tops of all slimes dams in the area draining to the Barrage will have been isolated. This should substantially reduce rainfall run-off and therefore the remaining pollution load due to mining.

A survey is being carried out by the Rand Water Board, assisted by other authorities and the Chamber of Mines, to determine details of the present dissolved loads delivered to the Barrage waters and where they originate. In addition, our research laboratories are carrying out surveys in the Witbank and Natal Coal fields to investigate the sources and degree of polution.

In the Witbank area the Department of Water Affairs is carrying out extensive surface reshaping and drainage, where abandoned coal-mine surfaces have caved in. Working collieries in the Transvaal, Natal and Orange Free State have undertaken and continue to introduce preventative measures to reduce pollution.

Author's Reply

Dr G. J. Stander (Visitor): With regard to the point made by Dr van Staden about fluorine from chimney stacks, I think that there is already quite a lot of information available on the effects of fluorine on vegetation in the environment; I'm afraid I do not know whether the the Department of Health is responsible for taking action in this regard. We are not dealing with air pollution today, but we do know what does not go into the air goes into the water, and what does not go into the water, goes into the air and, therefore, this is quite an important point which he has made.

The points which Mr Daneel has made are quite valid. The distribution by rain of mineral loads accumulated on mining sites is the problem. That's why we find increased mineral loads occurring during the rainy season. During the dry season mine waters contribute a regular mineral load to rivers draining mining areas, constituting a minor contribution to the whole mineral pollution problem. The real problem lies in the sudden increase in total dissolved solids and hardness during the rainy season. This fact was established by Mr Mrost during his studies at Luipaardsvlei. It was proved beyond doubt that, as a result of evaporation, mineral salts accumulated on dumps during the dry season. The establishment of vegetation on mine dumps and the application of various other management techniques, will cut down the problem of mineralised stormwater. It is immaterial whether we are going to create the salt water environment in open dams or in underground mine workings in this area. All that we want is a large body of water which is organically clean—I am not worried about the mineral salt concentration in the water. We require a large body of saline water in one particular spot where large-scale desalination could be effectively applied. The underground mine workings on the Witwatersrand could be a very useful storage facility for the purpose.