Clinical and Other Notes.

THE USE OF ALUMINO FERRIC IN THE FIELD FOR THE TREATMENT OF WATER CONTAINING COLLOIDS.

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Colloidal impurities are often found in water from natural sources and are objectionable on account of the colour and turbidity that still persists even after filtration. The particles are ultramicroscopic in size and pass through the standard Army metal filters using filter powder (Kieselguhr) as the filter aid. Colloids can only be filtered out by a semi-permeable membrane, a process which is too slow for use in the field. The colloids must be coagulated until the particles are large enough to be precipitated or retained in the filters.

The particles have a negative charge and remain in suspension because they constantly repel one another; when subjected to an electric current they travel to the anode (cataphoresis). It is known that the addition of positively charged colloids such as the hydroxides of aluminium and iron neutralizes this negative charge. Mutual coagulation then takes place between the alumino ferric colloids and the colloids in the water. The particles no longer repel one another, they fuse and are therefore large enough to be held up by the filter bed. Precipitated aluminium hydroxide is inert in this respect; it acts only as a mechanical filter. For this reason the gelatinous film or aluminium hydroxide deposited on the cloth filters will remove coarse suspended matter but will allow colloids to pass through.

If colloids are to be coagulated it is essential, therefore, that the formation of the aluminium hydroxide should take place actually in the presence of the colloids in the water. Intimate mixing by means of a drip feed or continuous injection is required. Used in this way the dose of alumino ferric is not critical; it is not necessary for the floc to be so well formed that it will settle. Under-dosage of alumino ferric merely shows itself as a slight deterioration in the quality of the filtrate.

Existing Methods of Treatment.

In the field, water containing colloids can be treated with alumino ferric, using about 4 grains per gallon, and the preliminary coagulation carried out in tanks. If time permits (4 to 6 hours) complete sedimentation is allowed and the clear supernatant water then pumped through the filters. If time is short, only partial sedimentation is allowed, the floc being held back by the filters.

The Mobile Water Purifier has a dosing device known as a “Filtrader” or “Recharger.” This device feeds a small amount of filter powder (Kieselguhr) to the incoming water and is used when dealing with dirty water. The process, in practice, prevents the deposition of an impervious layer of mud on the outside of the Kieselguhr bed so that the filter retains its efficiency for longer pumping periods. Colloids, however, are not removed by this process and the filtered water is still highly coloured. Pre-sedimentation, partial or complete, in 1,200 gallon tanks is necessary if a clear water is to be provided.

Suggested Methods.

In the field, extra pumps and tanks are not always readily available; moreover, a supply of clear water may be required at once.

The following methods have been developed at the Army School of Hygiene whereby crystal clear water can be obtained immediately in these circumstances from water containing large quantities of colloids.
Method 1 (Bulk Method).—Using the Mobile Water Purifier, Mk. II, the Filtraider being used as a dosing device for alumino ferric.

The Filtraider adds Kieselguhr on the suction side of the pump and sufficient alumino ferric solution is added to the Filtraider tank to dose the water with 1 to 2 grains per gallon. The churning action of the Mono pump ensures intimate mixing with the colloids of the water.

A trial was made using a particularly bad lake water (pH value 7.0). Attempts to filter out a crystal clear water without preliminary coagulation had failed, the filtrate being highly coloured. The water contained 8 parts per 100,000 suspended solids, which were removed by an asbestos filter, but the resulting filtrate was still deep chocolate brown in colour.

Purification by Mobile Water Purifier, Mk. II, with and without alumino ferric.

<table>
<thead>
<tr>
<th>Filtraider in action</th>
<th>(A)</th>
<th>(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumino ferric added</td>
<td>Nil</td>
<td>8 oz.</td>
</tr>
<tr>
<td>Quality of filtrate</td>
<td>Deep chocolate</td>
<td>Crystal clear</td>
</tr>
<tr>
<td>Volume of water filtered</td>
<td>2,500 gallons</td>
<td>2,500 gallons</td>
</tr>
</tbody>
</table>

The method in "B" of using alumino ferric in the Filtraider tank was as follows:—

Four ounces of alumino ferric was dissolved in about a gallon of water and added to the Filtraider tank. A further 4 ounces was dissolved in a bucket of water and added gradually as the quality of the filtrate deteriorated.

The trial was repeated using a slightly acid water (pH value 6.0). This water was obtained from a pit dug in clay subsoil and received drainage from the surrounding peaty land. The suspended solids were 8.5 parts per 100,000 but the filtrate was still highly coloured. Using the Filtraider alone, the filtrate was coloured but, when 1 to 2 grains per gallon of alumino ferric was added in the manner outlined above, an immediate improvement took place—a clear water being obtained.

It is to be noted that the first trial was carried out on a neutral water. Alkaline waters would react in a similar manner. The method was also successful in dealing with the slightly acid water in the second trial. With very acid water it may be necessary to add lime or substitute sodium aluminate for the alumino ferric.

After using the Mobile Water Purifier on twelve occasions with alumino ferric the filters were dismantled and inspected. They were clean and, on starting up, a rate of 3,000 g.p.h. was obtained. There is no evidence to suggest that the use of alumino ferric will reduce their efficiency provided that adequate backflushing is carried out.

The following instructions for the use of alumino ferric in the Filtraider tank of the Mobile Water Purifier, Mk. II, are suggested:

1. Alumino ferric only to be used when the filtrate is coloured or cloudy.
2. Filters and Filtraider tank charged and engine started up in the normal manner.
3. The Filtraider put into action and pump worked slowly.
4. Four ounces of alumino ferric dissolved in about a gallon of water and added to Filtraider tank. After this addition the filtrate will clear immediately.
5. A further 4 ounces of alumino ferric are dissolved and added in small quantities as and when the quality of the filtrate begins to deteriorate.

Method II. Use of Alumino Ferric with Unit Vehicles.—Alumino ferric may be used, with unit apparatus, for the treatment of water containing colloids even though tanks are not available.

Process (4).—The most economical method, if time permits and the nature of the source is suitable, is to dig a pit 4 by 4 by 4 feet (capacity about 400 gallons) at the water's edge and connect to the source by a channel. Four ounces (one-third Black cup) of crushed alumino ferric are dissolved in a gallon of water and allowed to drip into the incoming water. A dam is placed across the channel and partial or complete sedimentation carried out before filtering by the units vehicle.
If the source is to be used on several occasions, before leaving, the pit is refilled with water and dosed with alumino ferric. This method has the great advantage that, in dealing with dirty water, the silt is precipitated in the pit rather than retained in the filters, where its presence causes frequent clogging.

Process (B).—A pit is dug at the water’s edge large enough to hold a 10 pound Kieselguhr tin or a 4 gallon petrol tin. The floats and casing are removed from the suction hose and the strainers placed in the tin. Over the channel connecting the source to the pit a drip feed of alumino ferric solution is arranged. This solution is made up by dissolving about 1 ounce of alumino ferric in a gallon of water in another tin. The drip is controlled by means of a stick fitting into a nail hole. The dose is increased or decreased according to the quality of the filtrate. The life of the filter bed can be prolonged by mixing a 3 ounce charge of Kieselguhr in a jug of water which is added gradually to the water in the channel.

Process (C).—If the above methods are impracticable, clear water can be obtained by suspending the hose strainers inside a large tin into which about 20 pieces (marble size) of alumino ferric have been placed. The tin is suspended in the source and pumping commenced, more alumino ferric being added when the quality of the filtrate deteriorates.

Methods described above for using alumino ferric in the treatment of water containing colloids can be adapted for use with either the Mobile Water Purifier, Mk. II, or with unit vehicles. No extra equipment is required; alumino ferric is an R.A.S.C. supply.

This procedure will be found useful when a supply of clear water is required immediately or when tanks are not available for preliminary sedimentation.

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A MAP READING LIGHT.

By Captain F. P. Hallsworth,

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The night map reading device here described was designed to give clear illumination of a map at night, with the minimum of extraneous light, thus obviating the usual blackout difficulties and eliminating the danger of dazzling the driver when using a torch in reading a map in the car at night.

Early trials with improvised boxes proved very successful but showed that it was unsatisfactory to make the unit self contained as the “Y” type Mark II dry-battery proved too large and heavy and no smaller type of battery was found which could readily be replaced from stores in the field.

Finally it was decided to use an external Mark II carried on the web-equipment belt and,