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METHOD FOR PURIFYING BISMUTH

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Some metallurgical treatments—namely those concerning the metallurgy of copper, lead, silver and gold—give, as a subproduct, bismuth which is combined with important proportions of lead and sometimes with arsenic and traces of sulphur, copper etc. An average composition of these alloys is, for example:

	Per cent
Bismuth	70–75
Lead	25–30
Antimony	1–2

To extract bismuth from these alloys, in a state of purity which is sufficient to render it fit to its metallurgical and pharmaceutic uses, it is necessary to separate it from lead and eventually from arsenic.

The present invention has for its object a simple and economical method which permits to obtain this result.

The method according to this invention consists essentially to treat the previously pulverized alloy with a quantity of diluted nitric acid which exceeds slightly the quantity theoretically required to transform into nitrate all the lead of the alloy, this treatment being prolonged until all the lead is carried into solution in the form of nitrate and until the part of bismuth which was firstly transformed into nitrate is precipitated in the state of subnitrate.

In the practical realization of the invention diluted nitric acid is used in an excess of about 10 to 12% of the theoretical quantity corresponding to the lead of the alloy to be treated.

The treatment is advantageously executed at room temperature. Firstly, a brisk attack occurs which transforms the main part of the lead and some quantity of the bismuth into nitrates which go into solution, and afterwards the attack slows down. The mass is then submitted to a mechanical stirring, the contact being prolonged during several days in order to insure a complete elimination of the lead which has not been firstly attacked. This lead is transformed into nitrate to the detriment of the bismuth nitrate which has been formed and is dissolved by degrees causing thus a precipitation of metallic bismuth.

Finally, when the prolongation of the attack has nearly annuled the initial acidity of the solution, the bismuth which remains in the form of a nitrate is precipitated in the state of subnitrate. When the precipitation is finished, a mixture of metallic bismuth (and eventually arsenic) and bismuth subnitrate is formed, with a solution of lead nitrate in which are only traces of bismuth nitrate which may at their turn be precipitated by dilution.

All the lead of the alloy treated is thus eliminated, but the solid mass which is formed by the mixture of metal and bismuth subnitrate contains eventually the totality of the arsenic.

The method generally used for the elimination of this element consists in an oxidizing fusion of the metal, with addition of an alkaline nitrate, for example, sodium nitrate. According to the invention, the bismuth subnitrate present in the mass is advantageously used as oxidising agent. In fact this salt begins its decomposition at 100° C. with production of nitrous products which react upon the arsenic and transform it into arsenious anhydride which is volatile.

The reaction may be written in its simplest form:

$$2NO_3BiO + 2As \rightarrow Bi_2O_3 + As_2O_3 + 2NO$$

From this reaction, it may be seen that every 1 per cent in weight of As requires 2.8% of bismuth in the state of subnitrate.

This reaction is wholly realized at a temperature below the nascent red. The bismuth oxide thus formed remains as a slag which separates from the molten metallic bismuth and can be collected separately in view of recovering the bismuth by a subsequent reducing melting operation. The volatile arsenious anhydride which evolves during the reaction can be collected and condensed by any convenient known process.

As hereabove explained, amongst other advantages, the method according to the present invention does not necessitate the use of a special apparatus or of excessive quantities of reagent. The only subproduct obtained consists in lead nitrate.

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