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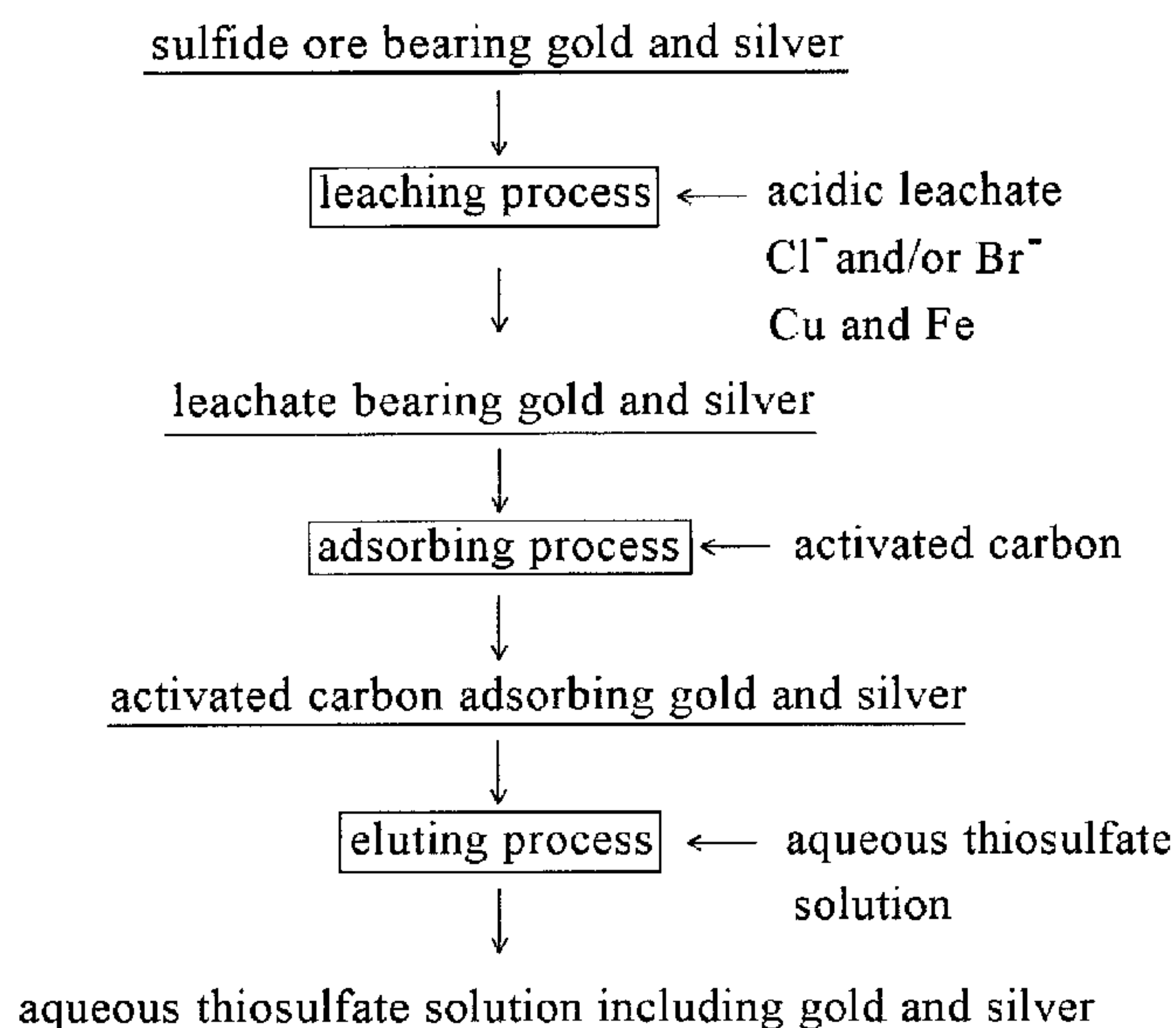
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L'UTILISANT

(54) Title: METHOD OF ELUTING GOLD AND SILVER AND METHOD OF RECOVERING GOLD AND SILVER USING
THE SAME



(57) Abrégé/Abstract:

Gold included in metal sulfide can be efficiently adsorbed on activated carbon and gold and silver adsorbed on the activated carbon can be efficiently eluted. The method of eluting gold and silver comprises:

leaching gold and silver using acidic leachate which includes chloride ions and/or bromide ions as anions and copper and iron as cations from sulfide ore bearing gold and silver to the acidic leachate by heating;

adsorbing at least the gold and silver in the acidic leachate on activated carbon; and

eluting gold and silver on activated carbon, on which at least the gold and silver are adsorbed, by using an aqueous thiosulfate solution that is maintained at less than pH 7.



ABSTRACT

Gold included in metal sulfide can be efficiently adsorbed on activated carbon and gold and silver adsorbed on the activated carbon can be efficiently eluted. The method of eluting gold and silver comprises:

leaching gold and silver using acidic leachate which includes chloride ions and/or bromide ions as anions and copper and iron as cations from sulfide ore bearing gold and silver to the acidic leachate by heating;

adsorbing at least the gold and silver in the acidic leachate on activated carbon; and

eluting gold and silver on activated carbon, on which at least the gold and silver are adsorbed, by using an aqueous thiosulfate solution that is maintained at less than pH 7.

DESCRIPTION

METHOD OF ELUTING GOLD AND SILVER AND METHOD OF RECOVERING
GOLD AND SILVER USING THE SAME

Technical Field

[0001]

The present invention relates to a method of eluting gold and silver and a method of recovering gold and silver using the method.

Background Art

[0002]

Gold and silver are metals of great value. These are present as fine metal particles in natural veins and included in small amounts as byproducts in pyrite, chalcopyrite, and other metal sulfide ores. Recovering methods are disclosed in, for example, Patent Literature 1 and the like, pyrometallurgical and hydrometallurgical recovery process for gold and silver are studied. In the case of hydrometallurgical process, gold or silver is dissolved in aqueous solution by leaching, and then adsorbed onto activated carbon. In recovering gold and silver from the recovered activated carbon, a recovering method by incinerating the activated carbon or a recovering method by eluting gold into a solution is conducted.

[0003]

In addition, an elution method using a solution obtained by mixing sodium sulfide with an aqueous sodium hydroxide solution is known as a method of preferentially eluting gold from activated carbon to which both of gold and silver of a cyanide solution including both of the gold and silver are adsorbed (Patent Literature 2).

[0004]

In many cases, gold is not only included in gold veins, but also included in a small amount as a byproduct in pyrite, chalcopryrite, and other metal sulfide ores. The gold is separated in smelting of main components thereof and smelted to separate metal gold.

[0005]

In the case of gold included as a byproduct in metal sulfide ore, for example, chalcopryrite, the gold generally moves to an anode in a pyrometallurgical process and is then condensed into the slime in an electrolytic refining process. The gold in the electrolytic slime is recovered as metal gold through a hydrometallurgical method (Patent Literatures 3 and 4) or a pyrometallurgical method.

[0006]

Recently, smelting techniques have been studied to treat concentrates through hydrometallurgical method without using pyrometallurgical method in consideration of environmental burden and impurities in the concentrates,

and the gold leaching method using strong acid with an sufficient oxidation potential for melting noble metal is proposed (Patent Literature 5). The method disclosed in Patent Literature 5 discloses that, when gold is leached by the acidic halide solution, the halide forms a stable complex with noble metal such as gold, but it interacts weaker than cyanide (Paragraph [0017] of the specification in Patent Literature 5). In addition, the method discloses that in the solution containing the noble metal, the noble metal can be adsorbed on activated carbon and recovered, and further discloses that the activated carbon is incinerated or eluted with a cyanide solution to use an eluent thereof in electrowinning to thereby recover the noble metal (Paragraph [0019] of the specification in Patent Literature 5). In addition, an adsorbent including a lignin derivative as a raw material is also known as an adsorbent of gold (Patent Literature 6).

Citation List

Patent Literature

[0007]

Patent Literature 1: JP 6-145828 A

Patent Literature 2: US 2579531

Patent Literature 3: JP 9-316561 A

Patent Literature 4: JP 2001-316735 A

Patent Literature 5: JP 2006-512484 A

Patent Literature 6: JP 2005-305329 A

Summary of Invention

[0008]

It is known that both an elution speed and recovering ratio will be improved when cyanide solution is used as an eluent for eluting gold and silver adsorbed on activated carbon. However, cyanide solution has toxicity, and thus there are many restrictions for using it. Accordingly, a recovering method for gold and silver adsorbed on activated carbon by eluting them efficiently without using the cyanide solution has been eagerly anticipated.

[0009]

In addition, as an example of a method for leaching gold, using acid, with high efficiency without using cyanide, a strong oxidant is required due to the stability of gold, and the leaching entails a lot of costs. In addition, in order to leach the gold in gold-bearing sulfide ore, it is necessary to leach sufficiently metal sulfide ore which is a main component, thereby sufficiently gold and the leachate contact with each other. Even when the gold in primary copper sulfide ore or pyrite is dissolved in this manner, the concentration of the gold leached into the

solution is quite low as compared with that in the case using cyanide.

[0010]

Therefore, even when leaching is performed with acid, it is necessary to further condense the gold through an adsorption method or a solvent extraction method in the subsequent process. In the adsorption method, activated carbon is known as an adsorbent, but it is necessary to use cyanide in the elution of gold which is adsorbed as metallic gold. When cyanide is not used, the gold is recovered by incinerating activated carbon and thus the cost increases as compared with the case of elution. In addition, in the case of the adsorbent as described in Patent Literature 6, the cost increases or a problem occurs in that the adsorbent cannot be used repeatedly, whereby it is not yet commercialized.

[0011]

In the case of solvent extraction, extraction, settling, and back extraction facilities are necessary. And the extracting selectivity for gold becomes a problem because the gold concentration is significantly low compared with the impurities concentration so that an adsorption method which may be more simply operated is preferred.

[0012]

The present inventors have constantly conducted studies for resolving the above-described problems, and as a result, found that when metal sulfide leaching is performed using a halogen bath to leach gold and silver together with main metal components, the resulting gold and silver leachates are treated by activated carbon, and then elution is performed with an aqueous thiosulfate solution that is maintained at predetermined pH, gold included in metal sulfide can be efficiently adsorbed on the activated carbon and the gold and the silver adsorbed on the activated carbon can be efficiently eluted.

[0013]

According to an aspect of the invention that has been completed based on such research findings, there is provided a method of eluting gold and silver comprising:

leaching gold and silver using acidic leachate which includes chloride ions and/or bromide ions as anions and copper and iron as cations from sulfide ore bearing gold and silver to the acidic leachate by heating;

adsorbing at least the gold and silver in the acidic leachate on activated carbon; and

eluting gold and silver on activated carbon, on which at least the gold and silver are adsorbed, by using an

aqueous thiosulfate solution that is maintained at less than pH 7.

[0014]

In an embodiment of the method of eluting gold and silver according to the invention, the aqueous thiosulfate solution is maintained at more than or equal to pH 4 and less than pH 7.

[0015]

In another embodiment of the method of eluting gold and silver according to the invention, the aqueous thiosulfate solution is maintained at 20 to 90°C.

[0016]

In a further embodiment of the method of eluting gold and silver according to the invention, the gold adsorbed on activated carbon is selectively eluted and separated by maintaining the aqueous thiosulfate solution at 60 to 90°C.

[0017]

In a further embodiment of the method of eluting gold and silver according to the invention, the silver adsorbed on activated carbon is selectively eluted and separated by maintaining the aqueous thiosulfate solution at 20 to 50°C.

[0018]

In a further embodiment of the method of eluting gold and silver according to the invention, the aqueous thiosulfate solution is aqueous sodium thiosulfate solution.

[0019]

In a further embodiment of the method of eluting gold and silver according to the invention, the sulfide ore bearing gold and silver is concentrate including at least one selected from the group consisting of chalcocite, bornite, covellite, chalcopyrite, pyrite, enargite, and arsenopyrite.

[0020]

In a further embodiment of the method of eluting gold and silver according to the invention, the sulfide ore bearing gold and silver is a residue including gold and silver obtained by pre-treating a concentrate of chalcocite, bornite, covellite, chalcopyrite, pyrite, enargite, or arsenopyrite, or any combination thereof, so as to leach out copper, iron or arsenic, which are main metal components, by 80% or greater using an acidic solution, and then performing a solid-liquid separation to recover said residue.

[0021]

In a further embodiment of the method of eluting gold and silver according to the invention, in the acidic leachate, 40 to 200 g/L of chloride ions, 20 to 100 g/L of bromide ions, 5 to 25 g/L of copper, and 0.01 to 10 g/L of iron are included, and the pH is 0 to 1.9.

[0022]

In a further embodiment of the method of eluting gold and silver according to the invention, the leaching by heating is performed at 60 to 100°C.

[0023]

According to another aspect of the invention, there is provided a method of recovering gold and silver from the aqueous thiosulfate solution including the gold and silver which are obtained by the method of eluting gold and silver according to the invention.

Advantageous Effects of Invention

[0024]

According to the invention, gold included in metal sulfide can be efficiently adsorbed on activated carbon and gold and silver adsorbed on the activated carbon can be efficiently eluted.

Brief Description of Drawings

[0025]

Fig. 1 shows a flowchart illustrating a method of eluting gold and silver according to an embodiment of the invention.

Fig. 2 shows a chart illustrating an adsorbed amount of Ag on the activated carbon with respect to a leachate passing time obtained in Example 2.

Fig. 3 shows a chart illustrating a concentration of Au in solution with respect to an elution time obtained in Example 3.

Fig. 4 shows a chart illustrating a concentration of Ag in solution with respect to an elution time obtained in Example 3.

Fig. 5 shows a chart illustrating a concentration of Au in solution obtained in Example 4.

Fig. 6 shows a chart illustrating a concentration of Ag in solution obtained in Example 4.

Description of Embodiments

[0026]

Fig. 1 shows a flowchart illustrating a method of eluting gold and silver according to an embodiment of the invention. A method of eluting gold and silver according to the present invention comprises:

leaching gold and silver using acidic leachate which includes chloride ions and/or bromide ions as anions and copper and iron as cations from sulfide ore bearing gold and silver to the acidic leachate by heating;

adsorbing at least the gold and silver in the acidic leachate on activated carbon; and

eluting gold and silver on activated carbon, on which at least the gold and silver are adsorbed, by using the aqueous thiosulfate solution that is maintained at less than pH 7.

[0027]

In many cases, a slight amount of gold is included as fine metal particle in metal sulfide ores such as chalcocite, bornite, covellite, pyrite, enargite, and arsenopyrite. Therefore, in order to recover gold, first, it is preferable that the metal sulfide ore are crushed and then made into concentrate by the flotation method for condensation. In addition, if copper, iron, or arsenic, which are main metal components, are leached by 80% or greater from the concentrate using acidic leachate and solid-liquid separation is then performed, it is also possible to further condense the gold in leached residue and the treatment efficiency becomes favorable.

[0028]

As a method of leaching gold included in the metal sulfide ore or gold preferably condensed by the above-described concentrate or the residue after leaching of the main metal component, a leaching method using strong oxidizing acid such as aqua regia, a leaching method using cyanide, and the like are known, but any of them has some problems in environmental burden and safety. Particularly, the leaching using cyanide is a method which should be avoided since its usage is usually restricted due to the high toxicity

[0029]

In the case of leaching by strong oxidizing acid,

there is no appropriate method for further concentration of dissolved gold. And when the gold is adsorbed on activated carbon which is a well-known adsorbent or an adsorbent such as functional resins, the stripping efficiency is not enough whereby when incineration is performed for every adsorbent, the cost significantly increases. It is said why the stripping is not properly performed is that gold halide complex formed after strong acid leaching is reduced up to crude metal on the activated carbon.

[0030]

However, the following Non Patent Literature 1 discloses that when gold is leached under special conditions, it forms a polysulfide complex.

(Non Patent Literature 1) M. E. Berndt, T. Buttram, D. Earley III, W. E. Seyfried Jr., *Geochimica et Cosmochimica Acta*, 58, (2), 587-594, 1994.

The gold polysulfide complex is more stable than the halide complex, and is not easily reduced up to metallic gold even when it adsorbed on an adsorbent.

[0031]

On the contrary, in this invention, gold is dissolved as a polysulfide complex which is easily adsorbed onto activated carbon without the special conditions as disclosed in Non Patent Literature 1, and the gold adsorbed on the activated carbon is easily eluted with sodium

hydroxide and recovered.

[0032]

In the invention, first, using acidic leachate which contains chloride ions and/or bromide ions as anions and copper and iron as cations, gold is leached from sulfide ore bearing gold and silver to the acidic leachate by heating. The leaching temperature is preferably 60 to 100°C. The pH of the acidic leachate is preferably 0 to 1.9. The leaching of gold is more favorably performed if the leaching temperature and the pH of the leachate are adjusted in the above ranges, respectively.

[0033]

In the acidic leachate, chloride ions and bromide ions are each preferably contained in an amount of 20 to 200 g/L, and copper and iron are each preferably included in an amount of 0.01 to 30 g/L. Furthermore, in the acidic leachate, 40 to 200 g/L of chloride ions, 20 to 100 g/L of bromide ions, 5 to 25 g/L of copper and 0.01 to 10 g/L of iron are more preferably contained. By defining the composition of the acidic leachate in this manner, chalcopyrite, enargite, and the like which are unlikely to dissolve in acid may be favorably dissolved. In addition, when bromine is included, there is an effect of stabilizing the dissolved gold as Au (I).

[0034]

Valuable metals are leached by dissolving the metal sulfide in the acidic leachate through the above-described heating leaching process. The slightly included gold and silver are leached together with main metals. If it is necessary, after solid-liquid separation, the gold and silver included in residue are leached in the same manner with an acidic solution having this composition.

[0035]

Next, the gold in the acidic leachate is brought into contact with and adsorbed on activated carbon. The gold and silver may be brought into contact with activated carbon in a batch-type manner, or by continuously passing the acidic leachate through an adsorption tower filled with activated carbon.

[0036]

After the gold has been adsorbed on the activated carbon, it is necessary to keep the gold a polysulfide complex to elute easily, but for this, it is essential that S (-II) is present at the time of leaching. In the case of the invention, various metal sulfides correspond thereto.

[0037]

As the activated carbon, there are various activated carbons such as coconut shell activated carbon and coke activated carbon, and it may be derived from any of raw materials.

[0038]

In the invention, the aqueous thiosulfate solution that is maintained at less than pH 7 is used as an eluent. Examples of the thiosulfate salt may be sodium thiosulfate, potassium thiosulfate, and so on. It is particularly effective for eluting gold and silver to use sodium thiosulfate. When the pH of sodium thiosulfate solution is less than 7, the sodium thiosulfate is partially decomposed and forms sulfur.

[0039]

The aqueous thiosulfate solution elutes the gold and silver from the activated carbon and the eluted silver is made precipitation as silver sulfide. The precipitated silver sulfide is separated from the eluent and treated using a chemical reduction method or the like, and thus a silver metal may be recovered.

[0040]

Meanwhile, since gold is eluted with the aqueous thiosulfate solution, but gold does not form metal sulfides, and thus the gold remains in an eluted state in the eluent. If it is necessary, gold can also be recovered as metal gold from the eluent using a chemical reduction method, a solvent extraction-electrowinning method or the like.

[0041]

In the elution of gold and silver from activated

carbon, the concentration of thiosulfate ions is preferably adjusted with corresponding amounts of the gold and silver to be eluted. Particularly, since sulfide is necessary to recover silver as sulfide precipitation, it is claimed to decompose a significant amount of thiosulfate ions. In the case of over-decomposition of thiosulfate, sulfur is adsorbed onto the activated carbon and disrupts the elution of the gold and silver. Specifically, the concentration of thiosulfate ions of the aqueous thiosulfate solution may be adjusted to 0.01 to 1.0 mol/L. The elution effect is saturated at the concentration of thiosulfate ions of 0.5 mol/L. Needless to say, a necessary amount of thiosulfate varies with the amount of gold and silver adsorbed on activated carbon, but the gold and silver are not lost even when the elution is insufficient as described above. When an excessive amount of thiosulfate is added, the surface of the activated carbon would be covered with sulfur and the elution is inhibited. Accordingly, the practical concentration of thiosulfate is 0.01 to 0.5 mol/L.

[0042]

The aqueous thiosulfate solution which is used as an eluent is maintained at less than pH 7, and preferably more than or equal to pH 4 and less than pH 7, and more preferably more than or equal to pH 4.5 and less than pH 6. The thiosulfate solution maintained at less than pH 7

promotes the formation of sulfur caused by decomposing thiosulfate ions, and the eluted silver ions become to sulfide precipitation while favorably forming sulfur.

[0043]

It is preferable that an elution temperature should be adjusted in accordance with the concentration of thiosulfate ions. The decomposition of thiosulfate ions is promoted at 20 to 90°C. In order not to disrupt the elution of both of the gold and silver, when the concentration of thiosulfate ions is low, it is effect to prevent the surface of activated carbon from being covered by sulfur. So the elution is preferably performed at low temperature. When the elution temperature is close to the room temperature, it is possible to selectively elute and separate silver from gold and silver mixture adsorbed on activated carbon. In this respect, the elution temperature is more preferably adjusted to 20 to 50°C. On the other hand, a higher temperature is preferred from the viewpoint of an improvement in result of separation of the gold and silver, and specifically, the elution temperature is even more preferably 60 to 90°C. By maintaining the aqueous thiosulfate solution at 60 to 90°C in this way, the gold adsorbed on activated carbon can be selectively eluted and separated.

[0044]

After the silver is selectively eluted, as described above, from the activated carbon that gold and silver are adsorbed on, remained gold can be consecutively eluted from the activated carbon. In particular, the silver is selectively eluted from the activated carbon that gold and silver are adsorbed on, by immersing the activated carbon in the aqueous thiosulfate solution (eluent) that is maintained at 20 to 50°C and at less than pH 7. Then, a supernatant of the eluent including the eluted silver component is recovered. Next, the eluent is heated and maintained at 60 to 90°C, and the remained gold is eluted from the activated carbon to be recovered in the same way. Thus, gold and silver can be favorably separated and recovered from the activated carbon that gold and silver are adsorbed on.

[0045]

Further, after the gold is selectively eluted, as described above, from the activated carbon that gold and silver are adsorbed on, remained silver can be consecutively eluted from the activated carbon. In particular, the gold is selectively eluted from the activated carbon that gold and silver are adsorbed on, by immersing the activated carbon in the aqueous thiosulfate solution (eluent) that is maintained at 60 to 90°C and at less than pH 7. Then, a supernatant of the eluent

including the eluted gold component is recovered. Next, the eluent is cooled and maintained at 20 to 50°C, and the remained silver is eluted from the activated carbon to be recovered in the same way. Thus, gold and silver can be favorably separated and recovered from the activated carbon that gold and silver are adsorbed on.

[0046]

In addition, the activated carbon of the invention may be repeatedly used for adsorption of silver and gold even after elution of silver and gold. It is more preferable costwise.

[0047]

According to the above-described separation method of the invention, gold and silver adsorbed on activated carbon may be efficiently eluted by using thiosulfate solution as an eluent with a simple operation of adjustment pH.

Examples

[0048]

Hereinafter, Examples of the invention will be described. However, these Examples are provided in order to understand the invention and advantages thereof better and there is no intent to limit the invention.

[0049]

(Example 1)

Metal sulfide concentrate including gold (Cu: 17 mass%, Fe: 27 mass%, S: 25 mass%, Au: 90 ppm, chalcopyrite and pyrrhotite Fe_{1-x}S as main ores) was weighed to 35 g/L with respect to leachate. The leachate contained 180 g/L of Cl^- , 20 g/L of Br^- , 18 g/L of Cu^{2+} , and 2 g/L of Fe^{3+} , and a pH thereof was 1.5. The leachate was heated to 85°C and stirring was performed with air blowing at 0.1 L/min. The resulting leachate with the gold concentration of 2 mg/L or greater obtained in this manner was allowed to pass through a column filled with activated carbon derived from coconut shell (Activated Carbon MC manufactured by Taihei Chemical Industrial Co., Ltd.) to adsorb the gold onto the activated carbon. The gold concentration in the leachate after passing through the column was less than 0.1 mg/L.

The activated carbon was taken out from the column when the gold concentration of the activated carbon in the column accomplished about 7000 g/ton. The amount of the adsorbed gold was determined by cupellation and ICP-AES, and the result was 7500 g/ton.

[0050]

(Example 2)

Metal sulfide concentrate including silver (Cu: 17 mass%, Fe: 27 mass%, S: 25 mass%, Ag: 0.03 mass%, chalcopyrite and pyrrhotite Fe_{1-x}S as main ores) was weighed to 35 g/L with respect to leachate. The leachate contained

180 g/L of Cl^- , 20 g/L of Br^- , 18 g/L of Cu^{2+} , and 2 g/L of Fe^{3+} , and a pH thereof was 1.0. The leachate was heated to 65°C and stirring was performed with air blowing at 0.1 L/min. The resulting leachate with the silver concentration of 10 mg/L or greater obtained in this manner was allowed to pass through a column filled with activated carbon derived from coconut shell (Activated Carbon MC manufactured by Taihei Chemical Industrial Co., Ltd.) to adsorb the silver onto the activated carbon in a batch-type manner. The silver concentration in the leachate after passing through the column was less than 0.1 mg/L.

The amount (mg) of the adsorbed silver on the activated carbon was determined by cupellation and ICP-AES every predetermined leachate passing time. Fig. 2 shows a chart illustrating an adsorbed amount of Ag on the activated carbon with respect to the leachate passing time obtained in Example 2.

[0051]

(Example 3)

The activated carbon (granular coconut shell activated carbon manufactured by Taihei Chemical Industrial Co., Ltd.,) which have adsorbed the gold from leachate in which the gold had leached from concentrates was prepared. In the activated carbon, the concentration of Au was 9000 g/ton and Ag was 1400 g/ton. 0.1 M - sodium thiosulfate

solution was used as an eluent, and the pH was adjusted to 4 and the temperature of the eluent was adjusted to room temperature (20 to 30°C) and 80°C. The above-described activated carbon was immersed in the eluent, and then stirred. The solution was sampled at every one hour from the start and the concentrations of the gold and silver in the eluent were determined by ICP. Figs. 3 and 4 show the results of the concentrations of the gold and silver in the solution. As shown in Fig. 3, in the case of eluting at 80°C, it can be seen that gold was favorably eluted more than silver from the activated carbon. Further, in the case of eluting at 80°C, the Au concentration was 160 mg/L and the Ag concentration was less than 1 mg/L in the solution after 6 hours of the elution. In case of elution at 80°C, it was possible to separate the gold and silver, and also the elution rate of Au was improved. Meanwhile, as shown in Fig. 4, in the case of eluting at room temperature, it can be seen that silver was favorably eluted more than gold from the activated carbon. Further, in the case of eluting at room temperature, the Au concentration after 6 hours elution was 20 mg/L and the Ag concentration after 6 hours elution was 25 mg/L. Regarding the silver, the entire amount of the silver on the activated carbon was eluted.

[0052]

(Example 4)

The activated carbon (granular coconut shell activated carbon manufactured by Taihei Chemical Industrial Co., Ltd.,) which have adsorbed the gold from leachate in which the gold had leached from concentrates was prepared. In the activated carbon, the concentration of Au was 9000 g/ton and Ag was 1400 g/ton. 0.1 M - sodium thiosulfate solution was used as an eluent, and the pH was adjusted to 4, 6, 8 and the temperature of the eluent was adjusted to 80°C. The above-described activated carbon was immersed in the eluent, and then stirred. The solution was sampled at every one hour from the start and the concentrations of the gold and silver in the eluent were determined by ICP. Figs. 5 and 6 show the results of the concentrations of the gold and silver in the solution. As shown in Figs. 5 and 6, in the case of eluting by the eluent having pH 8, both gold and silver were poorly eluted.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of eluting gold and silver comprising:
providing sulfide ore that contains gold and silver;
leaching gold and silver from the sulfide ore to an acidic leachate which includes chloride ions and/or bromide ions as anions and copper and iron as cations by heating;
adsorbing at least the gold and silver in the acidic leachate on activated carbon; and
eluting gold and silver on activated carbon, on which at least the gold and silver are adsorbed, by using an aqueous thiosulfate solution that is maintained at less than pH 7.
2. The method of eluting gold and silver according to claim 1, wherein the aqueous thiosulfate solution is maintained at more than or equal to pH 4 and less than pH 7.
3. The method of eluting gold and silver according to claim 1 or 2, wherein the aqueous thiosulfate solution is maintained at 20 to 90°C.
4. The method of eluting gold and silver according to claim 3, wherein the gold adsorbed on activated carbon is selectively eluted and separated by maintaining the aqueous thiosulfate solution at 60 to 90°C.
5. The method of eluting gold and silver according to claim 3, wherein the silver adsorbed on activated carbon is selectively eluted and separated by maintaining the aqueous thiosulfate solution at 20 to 50°C.

6. The method of eluting gold and silver according to any one of claims 1 to 5, wherein the aqueous thiosulfate solution is an aqueous sodium thiosulfate solution.

7. The method of eluting gold and silver according to any one of claims 1 to 6, wherein the sulfide ore bearing gold and silver is a concentrate of chalcocite, bornite, covellite, chalcopyrite, pyrite, enargite, or arsenopyrite, or any combination thereof.

8. The method of eluting gold and silver according to any one of claims 1 to 6, wherein the sulfide ore bearing gold and silver is a residue including gold and silver obtained by pre-treating a concentrate of chalcocite, bornite, covellite, chalcopyrite, pyrite, enargite, or arsenopyrite, or any combination thereof, so as to leach out copper, iron or arsenic, which are main metal components, by 80% or greater using an acidic solution, and then performing a solid-liquid separation to recover said residue.

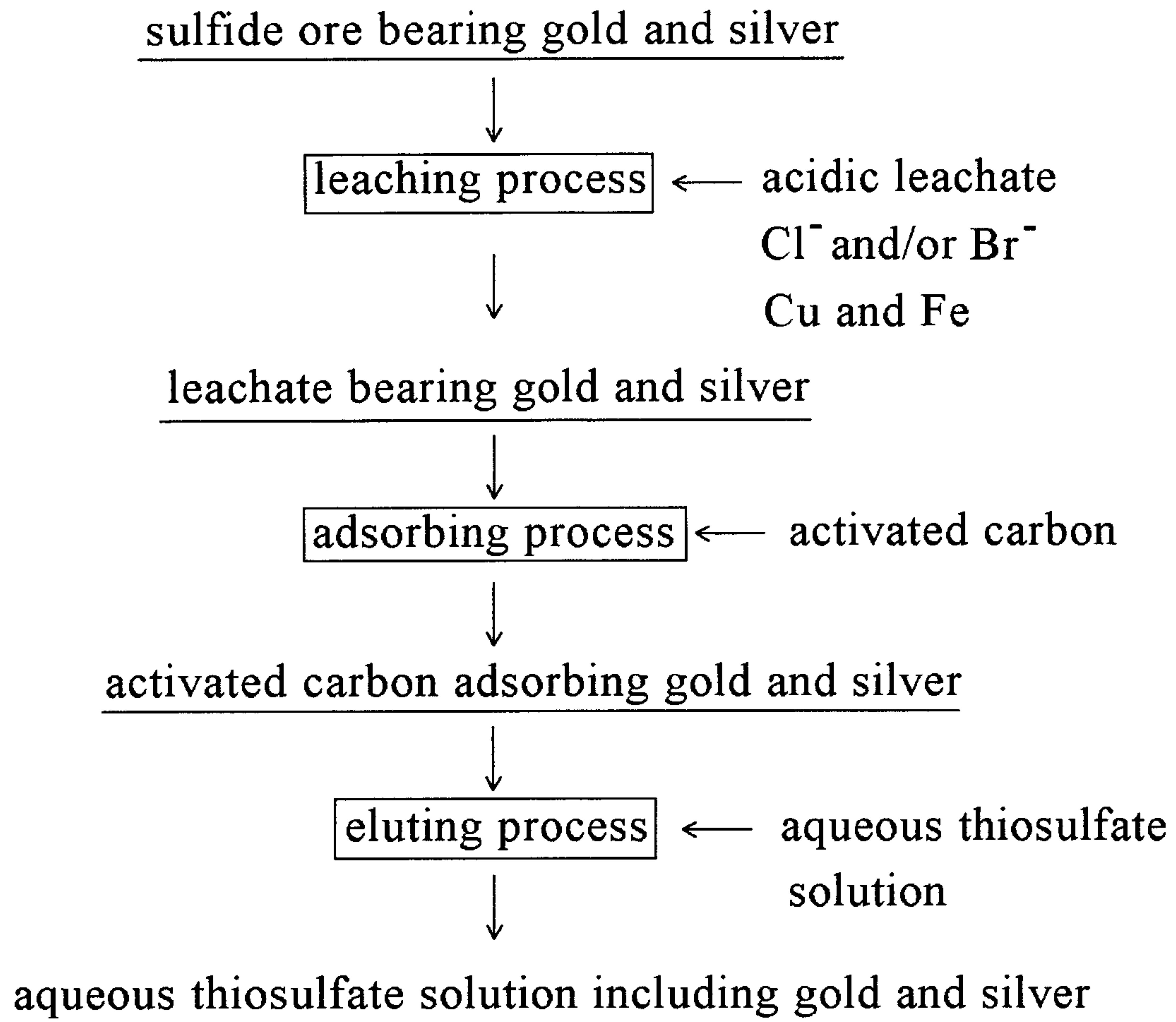
9. The method of eluting gold and silver according to any one of claims 1 to 8, wherein in the acidic leachate, 40 to 200 g/L of chloride ions, 20 to 100 g/L of bromide ions, 5 to 25 g/L of copper, and 0.01 to 10 g/L of iron are included, and a pH is 0 to 1.9.

10. The method of eluting gold and silver according to any one of claims 1 to 9, wherein the leaching by heating is performed at 60 to 100°C.

11. A method of recovering gold and silver from an aqueous thiosulfate solution including the gold and silver which

are obtained by the method of eluting gold and silver according to any one of claims 1 to 10.

FIG. 1



2/6

FIG. 2

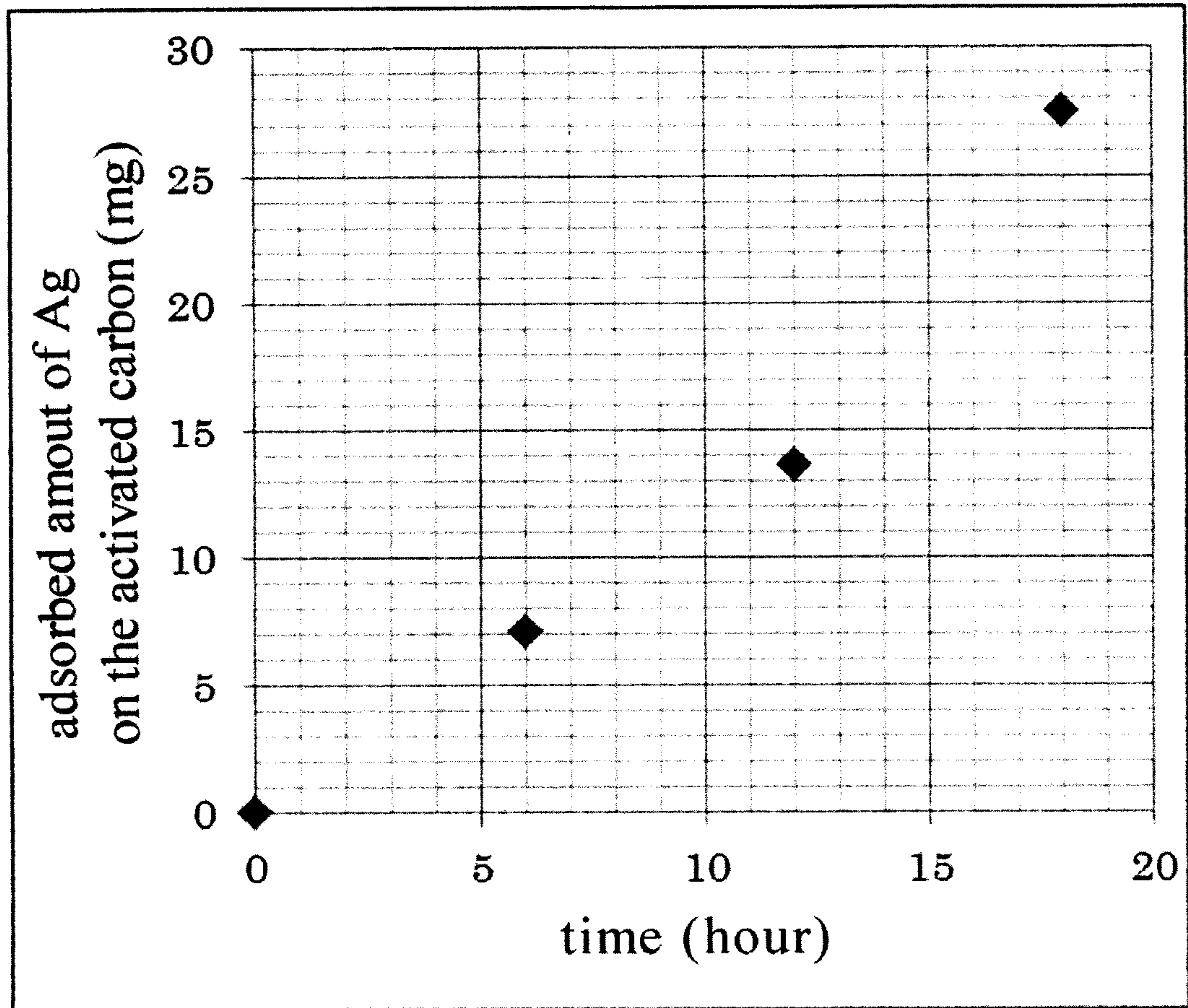


FIG. 3

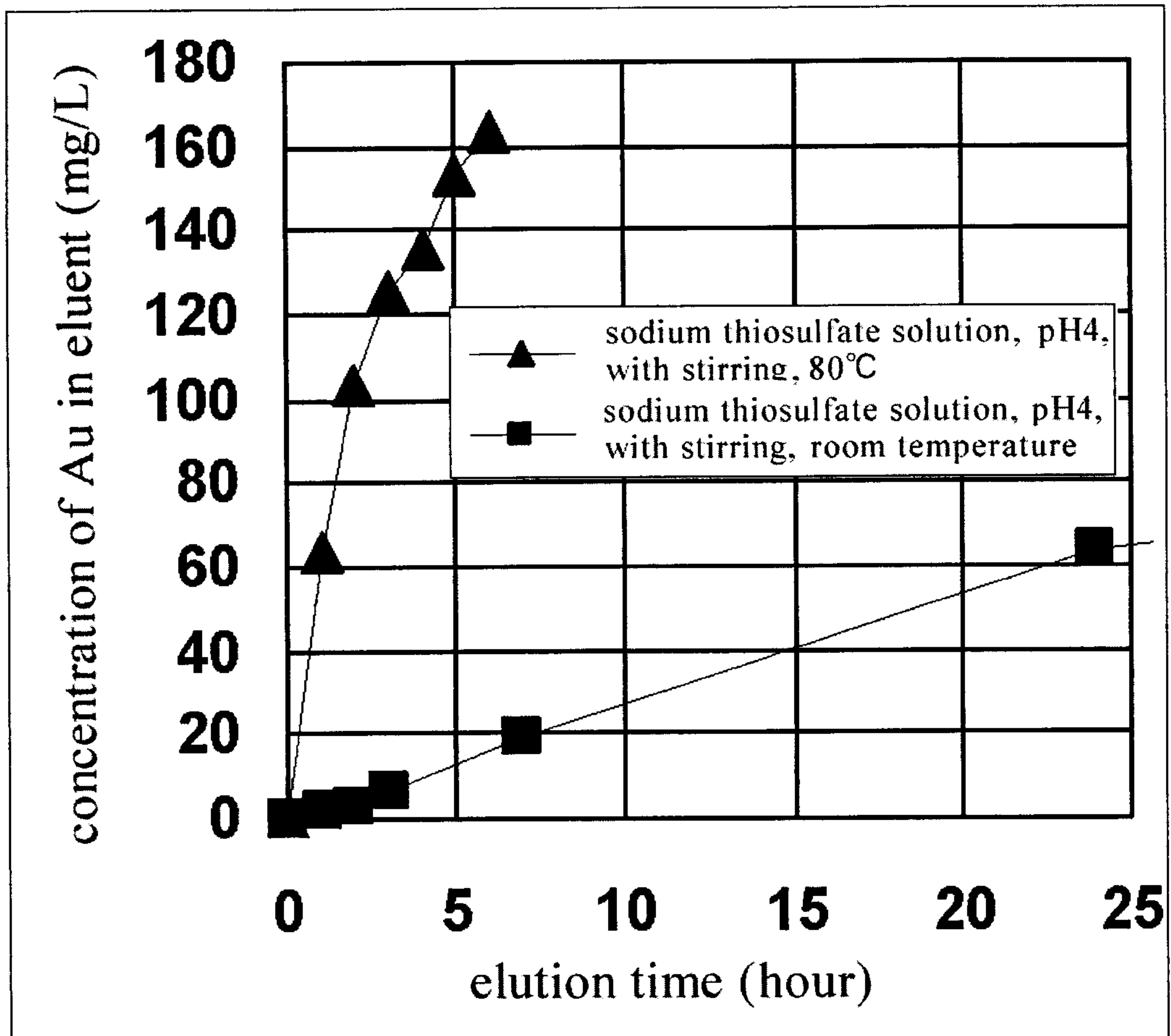


FIG. 4

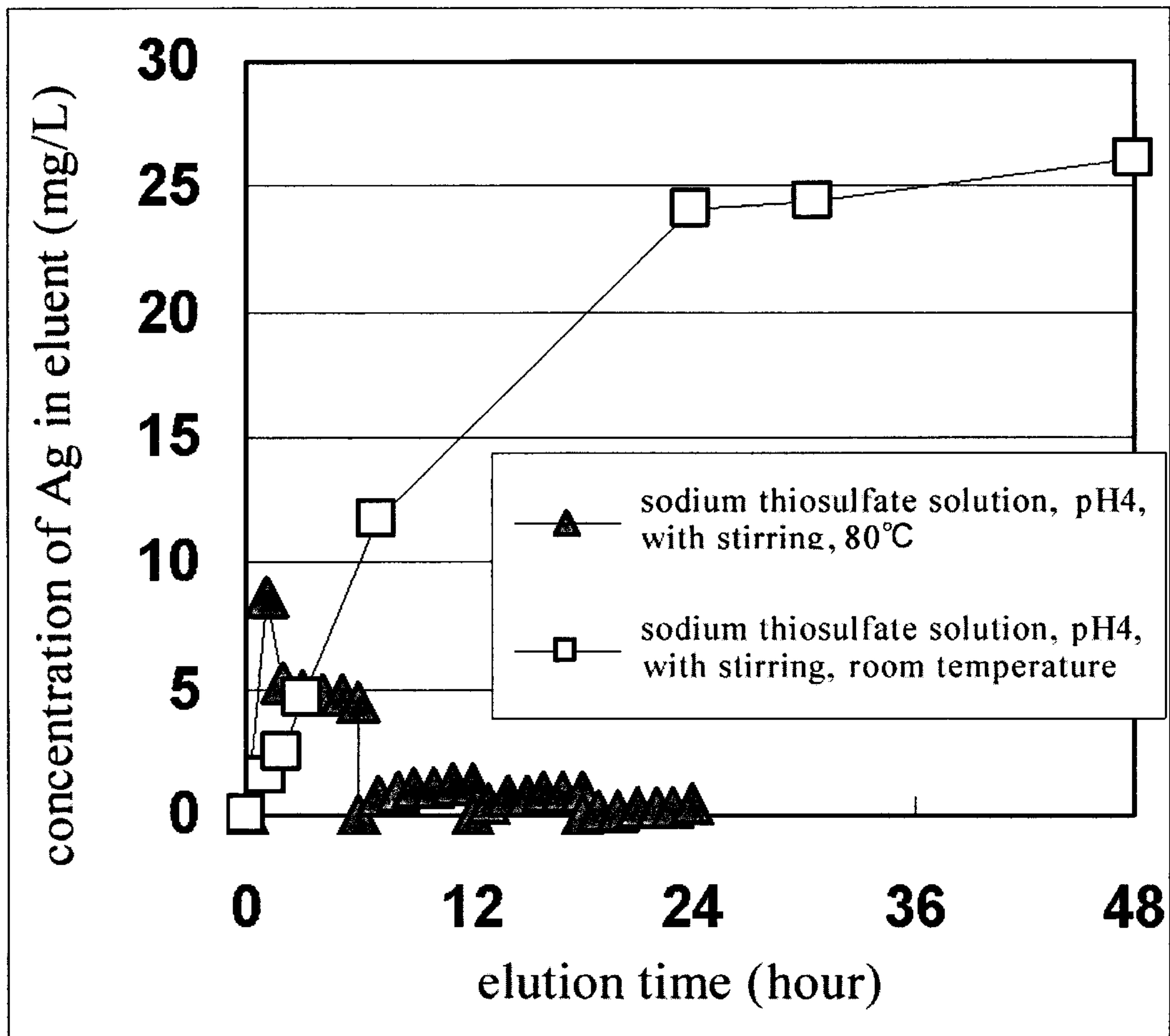


FIG. 5

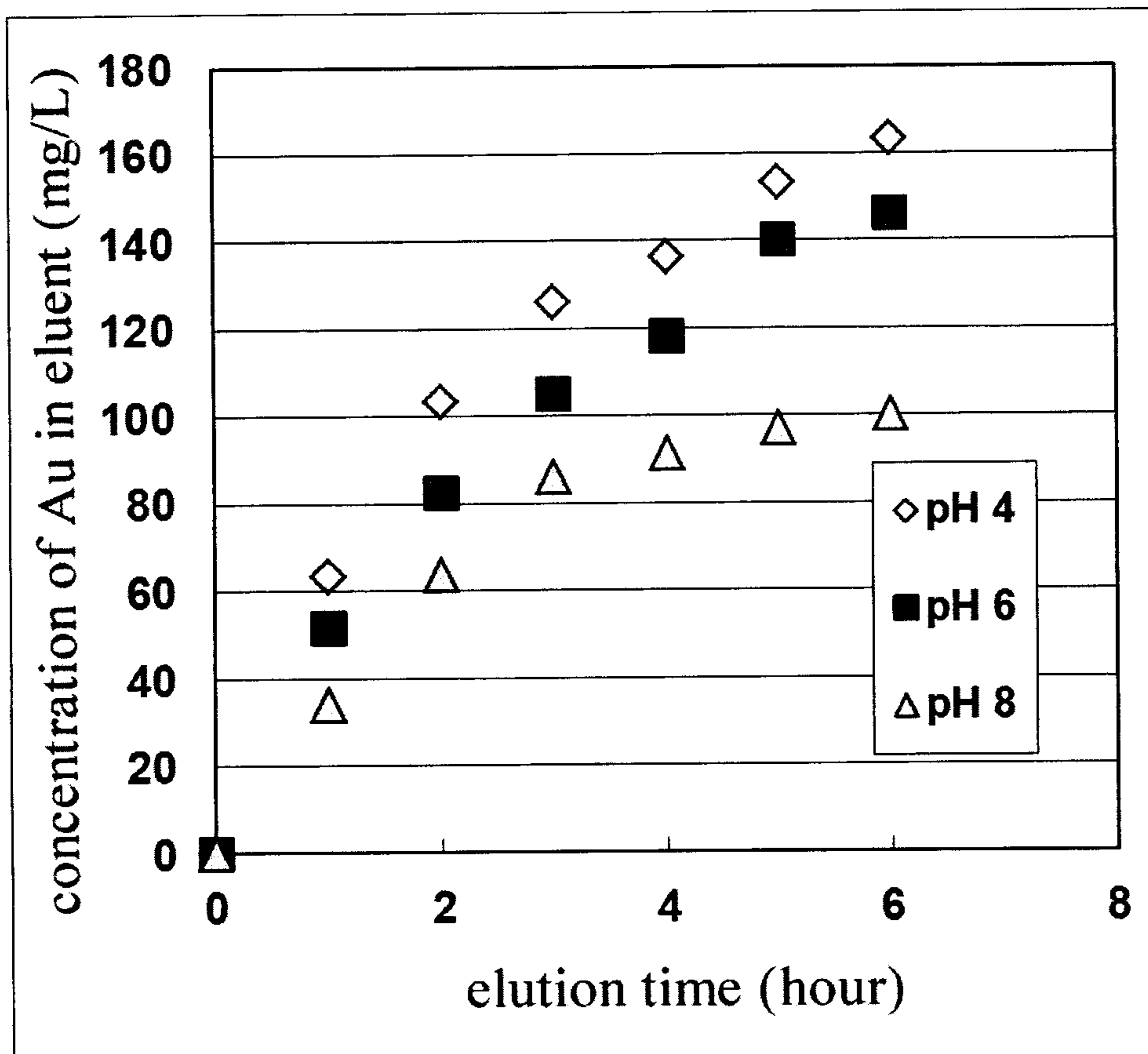


FIG. 6

