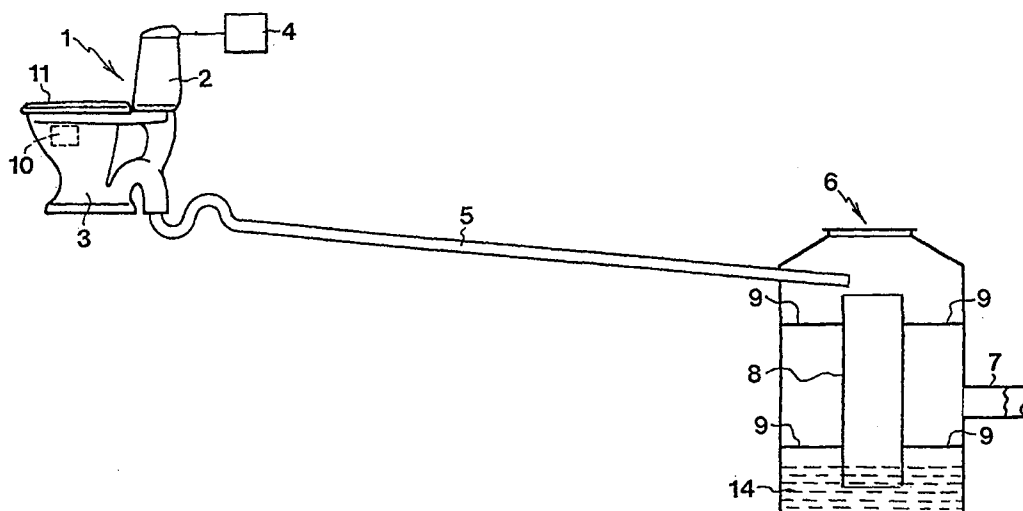




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(54) Title: METHOD OF PURIFYING SEWAGE



(57) Abstract

A method of purifying sewage is described. The method relates to purifying sewage in sewage systems which comprise a toilet (1) by adding a precipitant for precipitation of phosphates and for binding organic substance. The method is characterised in that the precipitant is selected from the group consisting of iron salts and aluminium salts, such as sulphates, chlorides and nitrates and is adapted to be flushed with water in the bowl (3) when flushing. In the method, the sewage from the toilet (1) is preferably conducted to a sludge separator through an outlet pipe (5, 8) which leads to the lower part of the sludge separator (6) below its outlet (7).

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METHOD OF PURIFYING SEWAGEField of the Invention

The present invention relates to a method of purifying sewage in sewage systems which comprise a toilet by adding a precipitant for precipitating phosphates.

5 Background of the Invention

Leakage of phosphorus from sewage systems, particularly those that are not connected to municipal sewage systems, is a growing problem. The sludge separation in such systems as are not connected to municipal sewage
10 systems is often formed as a two-compartment septic tank system or three-compartment septic tank system with an associated infiltration installation. The sewage system comprises at least one toilet and may also comprise outlets of washing machines, dishwashers and other sources
15 of sewage.

It is previously known to precipitate phosphate salts from such sewage systems by means of precipitants in the form of metallic salts such as iron salts or aluminium salts. Conveniently, the salts are selected from
20 the group consisting of sulphates, chlorides or nitrates. According to prior-art methods of precipitation, the precipitant is added to the sludge separator, for instance, by the precipitant either being provided in solid form in the sludge separator or dosed in liquid form in the
25 sludge separator.

Such prior-art methods are associated with disadvantages. When providing a solid precipitant in the sludge separator, it can be dissolved and supplied to the outlet continuously, independently of the supply of sewage to
30 the sludge separator, since the atmosphere in the sludge separator is saturated with water vapour that continuously can dissolve the precipitant. This implies an unnecessary high dosage of the precipitant, which entails a risk that the volume of the sludge in the sludge separa-

tor increases to such a degree that more frequent emptying intervals may be required. In time-controlled dosage of liquid precipitants, installation of electric current and of a dosing device in the sludge separator is required, which is expensive. Moreover, the time-controlled dosage occurs independently of the generation of sewage, which as in connection with the solid precipitant causes a risk of an unnecessarily high dosage of the precipitant and the volume of the sludge increasing so much that more frequent emptying intervals are required.

Consequently, there is a need for a method of precipitating phosphates and other pollutants in the sewage of sewage systems, particularly those not connected to municipal sewage treatment plants but comprising a sludge separator, for instance in the form of a two-compartment septic tank or three-compartment septic tank, and a toilet which is connected thereto, in which case the precipitation must be adapted to the supply of phosphates which is added to the sewage system.

Brief Description of the Invention

According to the invention, the above objects are achieved by a method of purifying sewage in sewage systems which comprise a toilet by adding a precipitant, characterised in that the precipitant is selected from the group consisting of iron salts and aluminium salts and is adapted to be flushed with water in the bowl when flushing.

Further features and advantages of the invention are apparent from the dependent claims and the following description.

Detailed Description of the Invention

In the following, the invention and preferred embodiments thereof will be described with reference to the accompanying drawing which schematically shows a sewage system in which the method according to the invention can be carried out.

The drawing shows a toilet 1 with a cistern 2 and a bowl 3. The cistern 2 is provided with a flushing device 4. From the toilet 1, an outlet pipe 5 extends to a sludge separator 6, such as a three-compartment septic tank. If a two-compartment septic tank or three-compartment septic tank is used, the Figure is supposed to show the first compartment of the septic tank. The outlet pipe 5 normally leads to the upper part of the sludge separator 6. The sludge separator 6 has an outlet 7. If the sludge separator is a two-compartment septic tank or three-compartment septic tank, the outlet 7 extends to the next compartment. 15 indicates the water level of the sludge container. According to a preferred embodiment, the sludge separator has an inner pipe 8 of, for instance, plastic or metal, preferably being attached to the sludge separator 6 by means of struts 9. Reference numeral 10 designates a solid precipitant which is provided in the bowl 3. Conveniently, the precipitant 10 is suspended from the edge 11 of the bowl with the aid of a suspension means (not shown), such as a hook.

Since the precipitant, as is evident from the above description, is only dosed when flushing the toilet, an undesirable overdosage of the precipitant and thus also an undesirable increase of the volume of sludge in the sludge separator are efficiently avoided. The invention gives instead the possibility of dosing the precipitant in an amount corresponding to the amount of precipitant which is required to precipitate the phosphate contents in the sewage in each flushing operation.

If other sources of phosphates are connected to the same sludge separator, such as a washing machine, a dishwasher or the like, the dosage of the precipitant in the toilet can be adapted thereto so that the dosage of the precipitant in the toilet when flushing exceeds the amount that is required for precipitation of the phosphates in the sewage from the toilet only. The dosage of the precipitant should instead correspond to the amount

that is required for precipitation of the total amount of phosphates and BOD in the sewage from the toilet and in the sewage from other sources of pollution, such as washing machines, dishwashers, sinks and the like.

5 The precipitant in the invention comprises an iron salt or an aluminium salt for precipitation of phosphates and oxygen-consuming substances. The iron and aluminium salts are preferably selected from the group consisting of sulphates, chlorides and nitrates. The iron salts may
10 be iron(III) salts or iron(II) salts.

 All metallic salts which are used to precipitate phosphates also precipitate particles, such as particles of organic matter, for instance, bacteria, virus and the like. By means of the invention also, inter alia, bacteria
15 will thus be bound in the sludge and the BOD content of the outgoing water will decrease.

 By using the invention, the COD content and BOD content of the outgoing sewage will thus decrease. In municipal plants which purify water by chemical purification only, more than 80 % of the BOD content and about
20 75 % of the COD content are precipitated in the incoming sewage. Corresponding figures of plants which purify water by mechanical purification only, as does a sludge separator, are about 30 %.

25 In addition to the metallic salt, the precipitant can, if necessary or desired, also comprise perfume, colour and/or disinfectants. The type of metallic salt which is used may be adapted to the circumstances. Aluminium salts give off their colour to a smaller extent than iron
30 salts and, thus, are to be preferred from an aesthetic point of view. However, iron salts have the advantage of stimulating the biological activity in the sludge separator. Also nitrate salts may stimulate the biological activity in such a manner that the BOD content of the outgoing water from the sludge separator decreases. Further-
35 more, nitrate salts may contribute to neutralise odour if any. Chloride salts have the advantage of often having a

higher solubility than sulphate salts and of causing fewer clogging problems.

If the sewage system comprises more outlet points than a toilet, for instance, if it comprises outlets of washing machines, dishwashers, wash-basins, bath-tubs and/or sinks, there is a risk that emissions, rich in phosphates, from, for instance, the washing machine at times reach the sludge separator. To bind and precipitate the phosphates, a certain amount of time is required for the phosphates of the sewage rich in phosphates to bind to the hydroxides in the sludge of the sludge separator before the water flows from the sludge separator to the infiltration installation. To facilitate binding and precipitation of the phosphates, the sludge separator 6 may preferably be given the form which is shown in the drawing and which has been briefly described above.

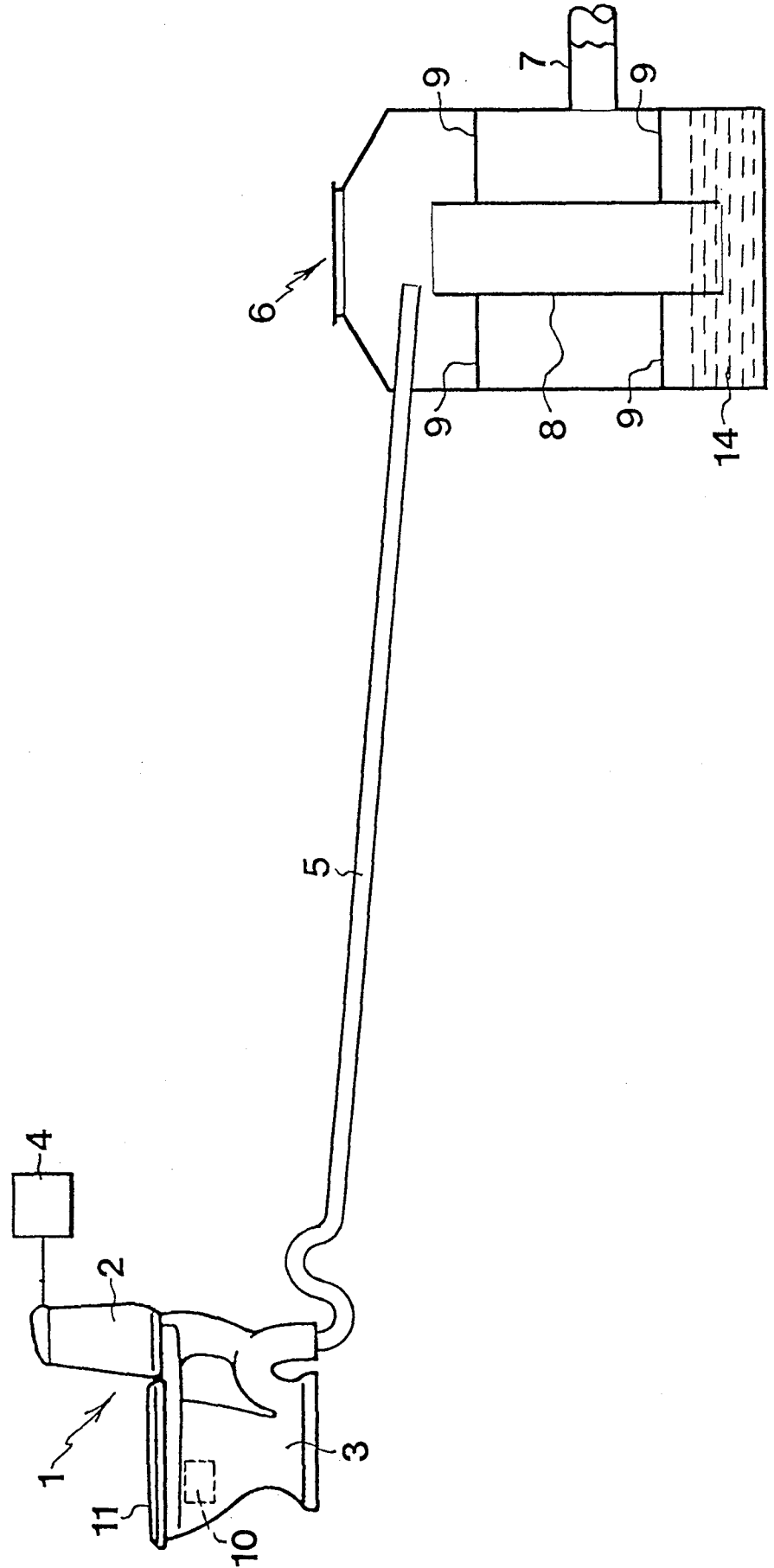
More specifically, the incoming sewage is conducted to the sludge separator through a pipe 8 which ends a distance above the bottom of the sludge separator but below the outlet 7. By this simple measure the incoming sewage will be forced to pass the sludge 14, thus facilitating the binding of both phosphates and particles, for instance bacteria, in the incoming sewage to the iron hydroxides or aluminium hydroxides, which are found in the sludge. As shown in the Figure, the pipe 8 can be kept in place in the sludge separator 6 by means of struts 9. The struts 9 may, for instance, consist of two tubes which are screwed together or of tubes which abut against the walls of the sludge separator by a spring mechanism (not shown). If required, an extension pipe is mounted on the inlet pipe 5 so that the incoming sewage flows down into the pipe 8.

In another somewhat simpler alternative, instead of extending the pipe 8 and the struts 9, the pipe 5 is extended so that it ends between the bottom and the outlet 7 of the sludge separator.

The invention has been described above with reference to the accompanying drawing and specific, preferred embodiments, but it will be appreciated that the invention is not limited thereto and can be varied within the
5 scope of the appended claims.

CLAIMS

1. A method of purifying sewage in sewage systems which comprise a toilet (1) by adding a precipitant, 5
c h a r a c t e r i s e d in that the precipitant is selected from the group consisting of iron salts and aluminium salts and is adapted to be flushed with water in the bowl (3) when flushing.
2. A method as claimed in claim 1, c h a r a c - 10
t e r i s e d in that the precipitant is solid and suspended from the edge (11) of the toilet.
3. A method as claimed in claim 1, c h a r a c -
t e r i s e d in that the precipitant is liquid and is dosed in the bowl (3) when flushing.
- 15 4. A method as claimed in claim 3, c h a r a c -
t e r i s e d in that the dosage is affected by activation of the flushing device (4) of the toilet or by the water level sinking when flushing.
5. A method as claimed in any one of the preceding 20
claims, c h a r a c t e r i s e d in that the sewage from the toilet (1) is conducted to the sludge separator through an outlet pipe (5, 8) which leads to the lower part of the sludge separator (6) below its outlet (7).
6. A method as claimed in any one of the preceding 25
claims, c h a r a c t e r i s e d in that the iron salts and aluminium salts are selected from the group consisting of sulphates, chlorides and nitrates.
7. A method as claimed in any one of the preceding 30
claims, c h a r a c t e r i s e d in that the precipitant is dosed in an amount exceeding that required for precipitation of the phosphates in the sewage from the toilet (1).



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02008

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E03D 9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 435080 B (INSINÖÖRITOIMISTO VESINIKSI OY), 3 Sept 1984 (03.09.84), page 1, line 29 - line 34, page 3, first and last paragraph, page 5, second and third paragraph --	1-7
A	US 3604021 A (A.C. NOLTE, JR.), 14 Sept 1971 (14.09.71), column 2, line 1 - line 32 --	1-7
A	US 2528403 A (M.H. WEST), 31 October 1950 (31.10.50), column 2, line 29 - column 3, line 15, abstract --	1-7

Further documents are listed in the continuation of Box C.

See patent family annex.

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Tommy Blomberg / MR

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2324083 A (KABUSHIKI-KAISHA MUSSHU), 14 October 1998 (14.10.98), abstract --- -----	1-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 435080 B	03/09/84	DE 3248993 A	20/10/83
		FI 64831 B,C	30/09/83
		FI 812511 A	15/02/83
		GB 2116161 A,B	21/09/83
		SE 8302021 A	12/04/83
		WO 8300713 A	03/03/83
US 3604021 A	14/09/71	US 3694354 A	26/09/72
US 2528403 A	31/10/50	NONE	
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		GB 9807470 D	00/00/00
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