SLUDGE DEWATERING WITH DUAL POLYMER CONDITIONING

This application is a PCT application that claims priority to Chinese Application Serial No. 201110344579x, filed October 25, 2011, the disclosure of which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

The disclosure pertains to a composition and method for assisting dewatering of sludge.

BACKGROUND

A large amount of sludge is generated in the activated sludge process for treating sewage and industrial wastewater. Currently, sludge treatment cost accounts for 25–45% of the operational cost for a typical wastewater treatment plant ("WWTP"). This cost is expected to keep rising with the increasing cost of landfill and incineration, especially in countries and areas with limited land space. Even after the dewatering process, a typical sludge contains a significant amount of water (70–85% by weight). Such high water content increases sludge disposal cost considerably, and as a result it is highly desirable for WWTPs to improve dewatering efficiency as much as possible.

In the dewatering process, sludge is usually conditioned using a cationic polyacrylamide-based polymer (flocculant). The conditioned sludge is then dewatered by a physical process such as centrifuge, belt press, or filter press. Flocculants can cause colloids and other suspended particles to aggregate and thus improve the sedimentation rate and filterability of the sludge.

Accordingly, there is a need for improved dewatering of sludge. Desirably, the improved dewatering of the sludge will result in cheaper disposal cost of the sludge.

SUMMARY ~~OF THE INVENTION~~

Flocculation is a key step for sludge dewatering. The present disclosure provides an improved flocculation process by incorporating a dual polymer conditioning program. In addition to the polymeric flocculant, a polymeric coagulant is also applied to the sludge to enhance flocculation efficiency. Compared to the traditional flocculant-only conditioning, this

dual polymer conditioning method can allow for the removal of more water from sludge, and thus lower the sludge disposal cost, such as that of a WWTP.

As such, the present disclosure is directed toward a method of treating a sludge. The sludge comprises water. The method comprises: providing the sludge; mixing a polymeric coagulant with the sludge to form a coagulated sludge; mixing a cationic flocculant with the coagulated sludge to form a flocculated coagulated sludge; and removing at least a portion of the water from the flocculated coagulated sludge. The polymeric coagulant comprises a copolymer of epichlorohydrin and dimethylamine ("Epi-DMA"), a homopolymer of diallyldimethylammonium chloride ("polyDADMAC"), or a combination of the two.

In an aspect, there is provided a method of treating a water-containing sludge, the method comprising: providing the water-containing sludge; mixing a polymeric coagulant selected from the group consisting of a copolymer of epichlorohydrin and dimethylamine, a homopolymer of diallyldimethylammonium chloride, and a combination thereof, with the sludge thereby producing a coagulated sludge; mixing a cationic flocculant with the coagulated sludge thereby producing a flocculated coagulated sludge; removing at least a portion of the water from the flocculated coagulated sludge.

In another aspect, there is provided a method of treating a water-containing sludge, the method comprising: providing the water-containing sludge; mixing a polymeric coagulant selected from the group consisting of a copolymer of epichlorohydrin and dimethylamine, a homopolymer of diallyldimethylammonium chloride, and a combination thereof, with the sludge thereby producing a coagulated sludge; mixing a cationic flocculant with the coagulated sludge thereby producing a flocculated coagulated sludge; removing at least a portion of the water from the flocculated coagulated sludge; wherein the polymeric coagulant comprises an epichlorohydrin and dimethylamine that is cross-linked by a cross-linking agent selected from the group consisting of ammonia, primary amines, alkylene diamines of from 2 to 6 carbon atoms, polypropylenepolyamines, polyethylenepolyamines, and a combination thereof; wherein the polymeric coagulant has a molecular weight in the range of one hundred thousand Daltons to three million Daltons; and wherein the polymeric coagulant is mixed with the sludge at a concentration of greater than 10 ppm but less than 800 ppm by weight.

These and other features and advantages of the present disclosure will be apparent from the following detailed description, in conjunction with the appended claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The benefits and advantages of the present disclosure will become more readily apparent to those of ordinary skill in the relevant art after reviewing the following detailed description and accompanying drawings, wherein:

FIG. 1 is a graphical illustration of the results of Example 1; and

FIG. 2 is a graphical illustration of the results of Example 2.

DETAILED DESCRIPTION OF THE INVENTION/PREFERRED EMBODIMENT

While the present disclosure is susceptible of embodiment in various forms, there will hereinafter be described a presently preferred embodiment with the understanding that the present disclosure is to be considered an exemplification of the disclosure and is not intended to limit the disclosure to the specific embodiment illustrated.

It should be further understood that the title of this section of this specification, namely, "Detailed Description of the Invention," relates to a requirement of the United States Patent Office, and does not imply, nor should be inferred to limit the subject matter disclosed herein.

The present disclosure is directed toward a method of using a composition of matter comprising an Epi-DMA or polyDADMAC, or a combination of the two. The Epi-DMA may be linear or cross-linked. If cross-linked, the cross-linked Epi-DMA may employ a cross-linking agent selected from the group consisting of ammonia, primary amines, alkylene diamines of

14. The method of claim 13, wherein the cross-linking agent comprises an alkylene diamine of from 2 to 6 carbon atoms.

15. The method of claim 14, wherein the alkylene diamine of from 2 to 6 carbon atoms is hexamethylenediamine.

16. The method of claim 13, wherein the removing the water is performed by a physical process.

17. The method of claim 16, wherein the physical process is selected from the group consisting of filtration, centrifugation, and combinations thereof.

18. The method of claim 13, wherein the polymeric coagulant and the sludge are pre-mixed prior to mixing the cationic flocculant.

19. The method of claim 13, wherein the sludge comprises a biological sludge, a primary sludge or a mixture of biological and primary sludge.

20. The method of claim 13, wherein the cationic flocculant comprises a polyacrylamide-based cationic polymer.