[0010] U.S. Pat. Nos. 10,286,390, 9,764,315, and 9,744,518 disclose that certain amorphous titanium silicate with pore volumes of at least 0.3 cc/g (mL/g) while using pore shaping conditions can be used to remove heavy metals including Sr, Pb, Hg. This prior art teaches the formation of pores where the pores are held to at least 0.3 cc/g in all instances. However, these aforementioned patents teach the limit of the heavy metal removal properties to media with desorption pore volumes greater than or equal to 0.3 cc/g. Moreover, this prior art does not define the specific total capacities for heavy metals.

[0011] The prior art clearly demonstrates that an array of titanosilicates can be made with different properties.

[0012] All sorption media have a finite capacity for contaminants. These are typically called *sites* where the contaminants may occupy a pore, a surface, or exchange with another ion. Both single layered and multi-layered sorption can occur, but capacities are considered finite. Since a media, or mixtures of media have finite capacities, the media or chemicals can be described in terms of total capacities. Capacities are used in a variety of forms in the literature but are typically a function of the structure and the environment. Theoretical capacities are calculated, while total capacities and in-process capacities are measured. Modifications can be made to make new media with higher capacities. The same is true for titanosilicates.

[0013] Refrigerator designers need more space in their refrigerator appliances; consumers always want more space for food and beverage storage. The water filters (for ice or drinking water) can take up significant space. There is an industrial need for new media with fast kinetics and higher capacities at smaller volume so that the space a refrigerator block filter takes up is minimized. Titanosilicate media are used in many of these applications. If the capacities of the titanosilicates can be increased, the carbon block manufacturers have several choices: make smaller blocks, certify the blocks for a higher volume, or add new additives to the blocks for more removal claims. It is therefore crucial and important that new media with additional capacity be introduced.

Summary

[0014] Bearing in mind the problems and deficiencies of the prior art, it is therefore an object of the present disclosure to provide a sorption media with a high

capacity to remove heavy metals, such as lead and mercury in particular. It has been determined that the capacity of the media to remove lead is increased by at least 10% when synthesized from a titanium source that contains sulfuric acid (black liquor, titanyl sulfate ($TiOSO_4$)) or sulfur.

[0014a] In an aspect, there is provided a media for the removal of metal cations comprising a Group 1 and/or Group 2 metal-titanosilicate having a Ti to Si molar ratio of 0.5-2, a pore volume of less than or equal to 0.25 cc/g, and a lead capacity of at least 280 mg/ dry g at 500 ppm of Pb.

[0014b] In another aspect, there is provided a process of removing heavy metals comprising contacting a solution containing heavy metals with a media comprising a Group 1 and/or Group 2 metal-titanosilicate having a Ti to Si molar ratio of 0.5-2, a pore volume of less than or equal to 0.25 cc/g, and a lead capacity of at least 280 mg/ dry g at 500 ppm of Pb.

[0014c] In another aspect, there is provided a method of producing a sorbent for the removal of ions from a liquid stream, comprising:

reacting soluble titanium with a mixture of a hydroxide and sodium silicate to produce a resultant product of titanosilicate and a group 1 and/or group 2 sulfate salt; and

filtering and washing said resultant product to remove the metal sulfate salt.

[0015] It is an example to provide filter media capable of removing heavy metals affected by pH.

[0016] Another example is to provide a less expensive filter media, that is at least equivalent in performance in removing heavy metals, including lead and mercury.

[0017] In another example, a filter media is provided capable of adjustable lead and mercury capacity, which can be tailored to the specific requirements of a project.

[0018] In yet another example, calcium hydroxide (slurry) is used to neutralize the reaction.

[0019] In another example, the titanium source may not be pure titanyl sulfate ($TiOSO_4$); rather, the precursor from an ilmenite dissolution process, such as Ti-Fe-sulfates ($TiOSO_4$, $Ti(SO_4)_2$, $FeSO_4$, and the like).

[0020] Precipitation is a recommended and advantageous step in the making of the various example of the present disclosure. In some instances, the pH of the solution is adjustable by adding high-pH inorganic additives.

Brief Description of the Drawings

[0021] The features of the invention believed to be novel and the elements characteristic of the invention are set forth with particularity in the appended claims. The figures are for illustration purposes only and are not drawn to scale. The invention itself, however, both as to organization and method of operation, may best be understood by reference to the detailed description which follows taken in conjunction with the accompanying drawings in which:

[0022] Fig. 1 is a chemical equation for the production of the product of the present invention;

[0023] Fig. 2 is a listing of titanium-based stoichiometries with respect to their theoretical and measured lead capacities;