(which increase NOM in the raw water entering the plant). The duration of reduced processing capacity is sometimes unpredictable and may last as long as several weeks. Failure to successfully control the problems associated with NOM can result in additional expense to water treatment processing. There is clearly a need for new and alternative devices and methods for removal of NOM from NOM contaminated water.

[0005] It would be advantageous to provide alternative devices for the removal of NOM from water, especially devices that can be used to remove a significant portion of NOM from NOM-contaminated water to thereby provide water with little or no NOM contaminants. It would also be advantageous to provide devices that can be retrofitted into existing water filtration plants.

Summary of Disclosure

[0006] Disclosed herein is a composite membrane comprising:

- a porous polyvinylidene fluoride (PVDF), polytetrafluoroethylene (PTFE) or nitrocellulose membrane body; and

- graphene oxide disposed on a surface of the membrane body.

[0006a] In an aspect, there is provided a composite membrane comprising:

- a porous polyvinylidene fluoride (PVDF), polytetrafluoroethylene (PTFE) or nitrocellulose membrane body; and

- graphene oxide disposed on a surface of the membrane body;

and wherein at least a portion of the graphene oxide is covalently bound to the membrane body via a crosslinking agent.

[0007] In some ~~embodiments~~examples, at least a portion of the graphene oxide is bound to the membrane body via a crosslinking agent. In some particular ~~embodiments~~examples, at least a portion of the graphene oxide is covalently bound to the membrane body via a crosslinking agent. In some particular ~~embodiments~~examples, the crosslinking agent is selected from 1,5-pentanediol, glutaraldehyde and glycol. In some ~~embodiments~~examples, the graphene oxide is in the form of a layer. In some ~~embodiments~~examples, the layer is a substantially continuous layer coating a surface of the membrane body. In some ~~embodiments~~examples, the graphene oxide has a C/O ratio in the range of from about 2.1 to about 4.5. In some particular ~~embodiments~~examples, the porous membrane body is a porous polyvinylidene fluoride (PVDF) membrane body. In some ~~embodiments~~examples,

the composite membrane is in the form of a hollow fiber composite membrane. In some particular ~~embodiments~~examples, the graphene oxide is disposed on an outer surface of the hollow fiber membrane.

[0008] In another aspect, ~~A~~also disclosed herein is an array comprising two or more composite membranes as set forth herein, the two or more composite membranes arranged in parallel in the array.

[0009] Also disclosed herein is a method of preparing a composite membrane, the method comprising:

(a) providing a porous polyvinylidene fluoride (PVDF), polytetrafluoroethylene (PTFE) or nitrocellulose membrane body; and

(b) filtering a dispersion comprising graphene oxide through the membrane body such that the continuous phase of the dispersion passes through a surface of the membrane body, thereby depositing graphene oxide on the surface of the membrane body.

[0009a] In another aspect, there is provided a method of preparing a composite membrane, the method comprising:

(a) providing a porous polyvinylidene fluoride (PVDF), polytetrafluoroethylene (PTFE) or nitrocellulose membrane body;

(a1) optionally treating the porous membrane body with a solvent to remove, completely or at least partially, any protective coating that may be present on the membrane body;

(a2) contacting the porous membrane body with a crosslinking agent; and

(b) filtering a dispersion comprising graphene oxide through the membrane body such that the continuous phase of the dispersion passes through a surface of the membrane body, thereby depositing graphene oxide on the surface of the membrane body.

[0010] In some ~~embodiments~~examples, the continuous phase of the dispersion comprising graphene oxide comprises at least 50 %v/v ethanol. In some ~~embodiments~~examples, the method further comprises an additional step, step (a1), before step (b) in which the porous membrane body is treated with a solvent to remove, completely or at least partially, any protective coating that may be present on the membrane body. In some ~~embodiments~~examples, the method further comprises an additional step, step (a2), after step (a) or step (a1), when included, and before step (b), in which the porous membrane body is contacted with a crosslinking agent.

[0011] In another aspect, ~~T~~this disclosure also provides a composite membrane prepared by the method as set forth herein.

[0012] In another aspect, ~~A~~also disclosed herein is a method of removing NOM from NOM-contaminated water, or water suspected of being contaminated with NOM, the method comprising passing the NOM-contaminated water, or water suspected of being contaminated with NOM, through a composite membrane as set forth herein, a composite membrane prepared by the method as set forth herein or an array as set forth herein.

Brief Description of the Figures

[0013] Specific embodiments of the present disclosure are described below, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of the preparation of graphene oxide (GO) as described in Example 1.

Figure 2 is a schematic diagram showing the filtration set-up used in Example 1 and shows pressure-controlled water flux measurement.

Figure 3(a) is a SEM image showing the surface morphology of the surface of the GO coating described in Example 1.