



US005914046A

**United States Patent** [19]  
**Watten**

[11] **Patent Number:** **5,914,046**  
[45] **Date of Patent:** **Jun. 22, 1999**

[54] **PROCESS AND APPARATUS FOR CARBON DIOXIDE PRETREATMENT AND ACCELERATED LIMESTONE DISSOLUTION FOR TREATMENT OF ACIDIFIED WATER**

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[57] **ABSTRACT**

[21] Appl. No.: **08/735,134**

The method of reducing the acidity in effluent discharges comprises charging the effluent with carbon dioxide, intermittently fluidizing and expanding at least one pulsed limestone bed with the charged effluent, treating the charged effluent with the limestone in the bed, displacing the limestone treated effluent with untreated charged effluent, stripping excess carbon dioxide from the effluent after treatment in the limestone bed, and discharging the limestone treated effluent. The method includes treating the charged effluent in the limestone beds for preferably at least two minutes, more preferably about 4 to 8 minutes. The step of intermittently fluidizing and expanding at least one pulsed limestone bed with the charged effluent includes generally concurrently intermittently fluidizing and expanding at least one other pulsed limestone bed with charged effluent, so that each limestone bed is expanded and fluidized alternately. The method also includes decreasing limestone bed sensitivity to limestone armoring by the intermittent fluidizing of the limestone beds and raising the pH of the treated effluent to at least 5. The mineral acidities in the effluent in excess of about 1,000 mg/l are neutralized and stripped CO<sub>2</sub> can be vented into the atmosphere or into untreated or partially treated effluent. The charging of the effluent takes place in at least one stage, and the stripping of the CO<sub>2</sub> takes place in at least one stage. The apparatus for the acid reduction method is also disclosed.

[22] Filed: **Oct. 22, 1996**

[51] Int. Cl.<sup>6</sup> ..... **C02F 1/20**

[52] U.S. Cl. .... **210/712; 210/718; 210/724; 210/750**

[58] Field of Search ..... **210/192, 195.1, 210/218, 712, 718, 724, 743, 749, 750, 198.1, 715**

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15 Claims, 12 Drawing Sheets

