CLAIMS

1. A system for wastewater treatment process control comprising

a plurality of measuring means arranged to obtain a dataset, the dataset comprises a plurality of process variables related to a parameter of the wastewater treatment process;

a prediction module arranged to receive the dataset and predict the parameter of wastewater treatment process utilizing a mathematical model, the mathematical model arranged to obtain the dataset as input and provide a predicted parameter as an output;

a troubleshooting module arranged to compare the predicted parameter with a predetermined criterion;

wherein if the predicted parameter does not satisfy the predetermined criterion; the troubleshooting module is operable to identify at least one process variable from the plurality of process variables which causes the predicted parameter not to satisfy the predetermined criterion, and determine whether the identified at least one process variable from the plurality of process variables is controllable.

2. The system according to claim 1, wherein the parameter of the wastewater treatment process is an effluent parameter of the wastewater treatment process.

3. The system according to claim 1 or 2, wherein the mathematical model comprises a moving-window partial least squares regression algorithm.

4. The system according to any one of the preceding claims, wherein the identification of the at least one process variable which causes the predicted parameter not to satisfy the predetermined criterion is based on a Hotelling T^2 or Q/SPE statistic.

5. The system according to any one of the preceding claims, wherein the predetermined criterion is in the form of a maximum value allowable, a range of acceptable or allowable values, or a minimum value allowable.

6. The system according to claim 1, wherein if the at least one process variable is controllable, the troubleshooting module obtains the median value of the at least

one controllable process variable and determines if the at least one controllable process variable is a root cause.

7. The system according to claim 6, wherein the determination of whether the at least one controllable process variable is a root cause includes comparing the median value of the at least one controllable process variable against a range of values the at least controllable process variable operates under normal condition.

8. The system according to claim 7, wherein if the controllable process variable falls outside the range of values, the controllable process variable is classified as a root cause.

9. The system according to claim 8, wherein the root cause is further classified as either a qualitative or a quantitative root cause.

10. The system according to claim 9, wherein if the root cause is a quantitative root cause, further calculations are provided to calculate an adjustment to the at least one process variable.

11. The system according to claim 9, wherein the troubleshooting module is operable to access a database to retrieve at least one corrective instruction to adjust the controllable process variable based on a set of pre-defined rules.

12. The system according to any one of the preceding claims, further comprising a prognosis module operable to simulate the impact of the adjustment of the at least one controllable process variable on the parameter of the wastewater treatment process.

13. The system according to any one of claims 1 to 11, further comprising a prognosis module operable to simulate the impact of adjustments of at least one process variable on the parameter of the wastewater treatment process.

14. The system according to any one of the preceding claims, further comprises an optimization module to optimize the plurality of process variables and parameter of wastewater treatment process with respect to at least one objective function.

15. A method for wastewater treatment process control comprising the steps of:

obtaining from a plurality of measuring means a dataset, the dataset comprises a plurality of process variables related to a parameter of the wastewater treatment process;

receiving the dataset at a prediction module and predicting the parameter of wastewater treatment process based on a mathematical model ;

comparing the predicted parameter with a predetermined criterion;

wherein if the predicted parameter does not satisfy the predetermined criterion; the troubleshooting module is operable to identify at least one process variable from the plurality of process variables which causes the predicted parameter not to satisfy the predetermined criterion and determine whether the identified at least one process variable from the plurality of process variables is controllable.

16. A troubleshooting module for use in wastewater treatment process control, comprising at least one processor in data communication with a plurality of measuring means to receive a dataset, the dataset comprises a plurality of process variables related to a parameter of the wastewater treatment process, and a value of the parameter of the wastewater treatment process; and thereafter compare the value of the parameter with a predetermined criterion;

wherein if the parameter does not satisfy the predetermined criterion; the troubleshooting module is operable to identify at least one process variable from the plurality of process variables which causes the predicted parameter not to satisfy the predetermined criterion and determine whether the identified at least one process variable from the plurality of process variables is controllable.

17. The troubleshooting module according to claim 16, wherein the identification of the at least one process variable which causes the predicted parameter not to satisfy the predetermined criterion is based on a Hotelling T^2 or Q/SPE statistic.

18. The troubleshooting module according to claim 16 or 17, wherein the predetermined criterion is in the form of a maximum value allowable, a range of acceptable or allowable values, or a minimum value allowable.

19. The troubleshooting module according to claim 16, wherein if the at least one process variable is controllable, the median value of the at least one controllable process variable is obtained and the troubleshooting module is operable to determine if the at least one controllable process variable is a root cause.

20. The troubleshooting module according to claim 19, wherein the determination of whether the at least one controllable process variable is a root cause includes comparing the median value of the at least one controllable process variable against a normal range.

21. The troubleshooting module according to claim 20, wherein if the controllable process variable falls outside the normal range, the controllable process variable is classified as a root cause.

22. The troubleshooting module according to claim 21, wherein the root cause is further classified as either a qualitative or a quantitative root cause.

23. The troubleshooting module according to claim 22, wherein if the root cause is a quantitative root cause, an adjustment to the process variable is calculated.

24. The troubleshooting module according to claim 23, wherein the troubleshooting module is operable to access a database to retrieve at least one corrective instruction to adjust the controllable process variable based on pre-defined rules.

25. The troubleshooting module according to any one of claims 16 to 24, further comprising a prognosis module operable to simulate the impact of the adjustment of the controllable process variable on the parameter.

26. The troubleshooting module according to claim 16, further comprising a prognosis module operable to simulate the impact of adjustments of at least one process variable on the parameter.

27. The troubleshooting module according to claim 23, further comprises a list of a plurality of quantitative and/or qualitative root causes and corresponding correction actions, wherein each corresponding adjustment is a corrective action.

28. The troubleshooting module according to claim 27, further comprises an optimization module arranged to permute the corrective actions in various combinations in accordance with the formula

$$\sum_{r=1}^{n} C(n,r)$$

where *n* denotes the total number of corrective actions identified.

29. The troubleshooting module according to claim 28, wherein a simulated parameter corresponding to each corrective action is determined and each simulated parameter is compared with the predetermined criterion.

30. The troubleshooting module according to claim 29, wherein if the simulated parameter satisfies the predetermined criterion, an objective function value is calculated, and where there comprises a plurality of objective function values, the lowest or highest objective function value is selected as an optimal solution.

31. The troubleshooting module according to claim 29 or 30, wherein if no simulated parameter is found to satisfy the predetermined criterion, a next best alternative based on adjusting a predetermined process variable is selected as the optimal solution.