CLAIMS

1. An acidogenic reactor system for use in a wastewater treatment plant, said system comprising an inhibitor, wherein the inhibitor is one or more volatile fatty acids and/or H_2 that is capable of regulating a microbial population and wherein the reactor system further comprises an acidogenic sludge comprising a microbial community of 90% Eubacteria and 10% *Archaea*.

2. The acidogenic reactor system of Claim 1, wherein:

the concentration of H_2 in the reactor is from 20 to 40%; and/or

the concentration of the one or more volatile fatty acids is greater than or equal to 3000 mg/L.

~~3. The acidogenic reactor system of Claim 1 or Claim 2, wherein the reactor system further comprises an acidogenic sludge.~~

~~4~~3. The acidogenic reactor of Claim ~~3~~1, wherein the concentration of H_2 and/or the concentration of the one or more volatile fatty acids is wholly generated *in situ* by a microbial population within the acidogenic sludge or is partly generated *in situ* by the microbial population and partly supplied by a supplementary stream of H_2 and/or one or more volatile fatty acids.

~~5~~4. The acidogenic reactor of Claim ~~4~~3, wherein the concentration of H_2 and/or the concentration of the one or more volatile fatty acids is partly generated *in situ* by a microbial population within the acidogenic sludge and partly supplied by a supplementary stream of H_2 and/or one or more volatile fatty acids.

~~6. The acidogenic reactor system of any one of Claims 3 to 5, wherein the acidogenic sludge comprises a microbial community of 90% Eubacteria and 10% *Archaea*.~~

~~7~~5. The acidogenic reactor system of Claim ~~6~~1, wherein the microbial community comprises:

fermentative bacteria;

hydrogen producing acetogenic bacteria;

homoacetogens; and

one or more H_2-consuming methanogens of the *Archaea* group.

~~8~~6. The acidogenic reactor system of Claim ~~7~~5, wherein the one or more H_2-consuming methanogens of the *Archaea* group are capable of functioning in an acidic environment.

~~9~~7. The acidogenic reactor system of Claim ~~8~~6, wherein the one or more H_2-consuming methanogens of the *Archaea group* comprise *Methanobacteriales* (MBT) and/or *Methanomicrobiales* (MMB).

~~10~~8. The acidogenic reactor system of any preceding claim, wherein the reactor system is substantially or wholly free of biofilms.

~~11~~9. The acidogenic reactor system of any preceding claim, wherein the wastewater treatment plant is a sewage plant or an industrial wastewater plant.

~~12~~10. The acidogenic reactor system of any preceding claim, wherein the acidogenic reactor system is fitted upstream of a one-stage anaerobic reactor or a methanogenic reactor.

~~13~~11. The acidogenic reactor system of any Claim ~~12~~10, wherein the acidogenic reactor system is fitted upstream of a methanogenic reactor.

~~14~~12. The acidogenic reactor system of any preceding claim, wherein the acidogenic reactor system further comprises an apparatus for recycling biogas produced by the acidogenic reactor system back into said acidogenic reactor system.

~~15~~13. The acidogenic reactor system of any preceding claim, further comprising pH, oxidation reduction potential (ORP) and temperature controllers.

~~16~~14. A method of generating biogas using an acidogenic reactor system, said method comprising the steps of:

(i) seeding the acidogenic reactor with anaerobic sludge as seed from an existing anaerobic system;

(ii) adding anaerobic sludge to the acidogenic reactor in a sequential batchwise or a continuous manner;

(iii) maintaining a pH range within the acidogenic reactor of 5.0-5.5 and a temperature between 30 and 50°C;

(iv) manipulating the concentration of an inhibitor in the acidogenic reactor to regulate the microbial population, where the inhibitor is selected from one or more volatile fatty acids and/or H_2;

(v) optionally recycling the biogas produced within the acidogenic reactor to the acidogenic reactor for further reaction;

(vi) transferring the treated anaerobic sludge to a downstream reactor of the one-stage anaerobic type or of the methanogenic type; and

(vii) repeating steps (iii) to (vi).

~~17~~15. The method of Claim ~~16~~14, wherein in step (v):

the concentration of H_2 in the gaseous phase of the acidogenic reactor is from 20 to 40%; and/or

the concentration of the one or more volatile fatty acids is greater than or equal to 3000 mg/L.

~~18~~16. The method of Claim ~~17~~15, wherein the concentration of H_2 in the gaseous phase of the acidogenic reactor reaches a peak level of from 20 to 40% during the start-up phase of the reactor and drops to from 0% to less than 20% thereafter; and

wherein the concentration of the one or more volatile fatty acids is greater than or equal to 3000 mg/L is achieved as the concentration of H_2 starts to drop from its peak level.

~~19~~17. The method of any one of Claims ~~16~~ 14 to ~~18~~16, wherein the ORP of the acidogenic reactor is about -400 mV and the temperature is 40±1°C.

~~20~~18. The method of any one of Claims ~~16~~ 14 to ~~19~~17, wherein the hydraulic retention time (HRT) is 1.25-5 days, and the solids retention time (SRT) is 10-25 days.

~~21~~19. The method of any one of Claims ~~16~~ 14 to ~~20~~18, wherein preceding step (i) the acidogenic reactor is cleaned to substantially or wholly remove biofilms.

~~22~~20. Use of volatile fatty acids (VFAs) and~~/or~~ H_2 to regulate the microbial population of an acidogenic reaction, ~~.~~

~~23. The use of Claim 22,~~ wherein the use comprises a reaction in an acidogenic reactor and:

~~the concentration of H_2 in the gaseous phase of the reactor is from 20 to 40%; and/or~~

~~the concentration of the one or more volatile fatty acids is greater than or equal to 3000 mg/L.~~

~~24. The use of Claim 23, wherein~~ the concentration of H_2 in the gaseous phase of the reactor reaches a peak level of from 20 to 40% during the start-up phase of the reactor and drops to from 0% to less than 20% thereafter; and

~~wherein~~ the concentration of the one or more volatile fatty acids is greater than or equal to 3000 mg/L is achieved as the concentration of H_2 starts to drop from its peak level.