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COMPARISON OF AEROBIC AND ANOXIC-AEROBIC DIGESTION OF WASTE ACTIVATED SLUDGE

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SUMMARY

The laboratory scale experimental investigation comprised a 6 day sludge age activated sludge process, the waste sludge of which was fed to a number of digesters operated as follows: single reactor flow through digesters at 4 or 6 days sludge age, under aerobic and anoxic-aerobic conditions (with 1,5 and 4 h cycle times) and 3-in-series flow through aerobic digesters each at 4 days sludge age; all digesters were fed draw-and-fill wise once per day.

The general kinetic model for the aerobic activated sludge process set out by Dold et al., (1980) and extended to the anoxic-aerobic process by van Haandel et al., (1981) simulated accurately all the experimental data (Figs 1 to 4) without the need for adjusting the kinetic constants.

Both theoretical simulations and experimental data indicate that (i) the rate of volatile solids destruction is not affected by the incorporation of anoxic cycles and (ii) the specific denitrification rate is independent of sludge age and is $K_{4T} = 0,046(1,029)^{(T-20)}$ $mgNO_3$-N/(mg active VSS.d) i.e. about 2/3 of that in the secondary anoxic of the single sludge activated sludge stystem. An important consequence of (i) and (ii) above is that denitrification can be integrated easily in the steady state digester model of Marais and Ekama (1976) and used for design (Warner et al., 1983).

KEYWORDS

Waste activated sludge; anoxic-aerobic digestion; alkalinity; oxygen consumption; VSS destruction.

COMPARISON

Aerobic Digester	Anoxic Aerobic Digester
Every mgVSS destroyed	
1. Requires 1,48 mgO for oxidation of VSS	Same
2. Requires 0,46 mgO for nitrification	Yields 60% reduction in nitrification oxygen demand
3. Destroys 0,36 mgAlk (as $CaCO_3$) and causes pH reduction	Yields zero Alk loss and maintains stable pH.

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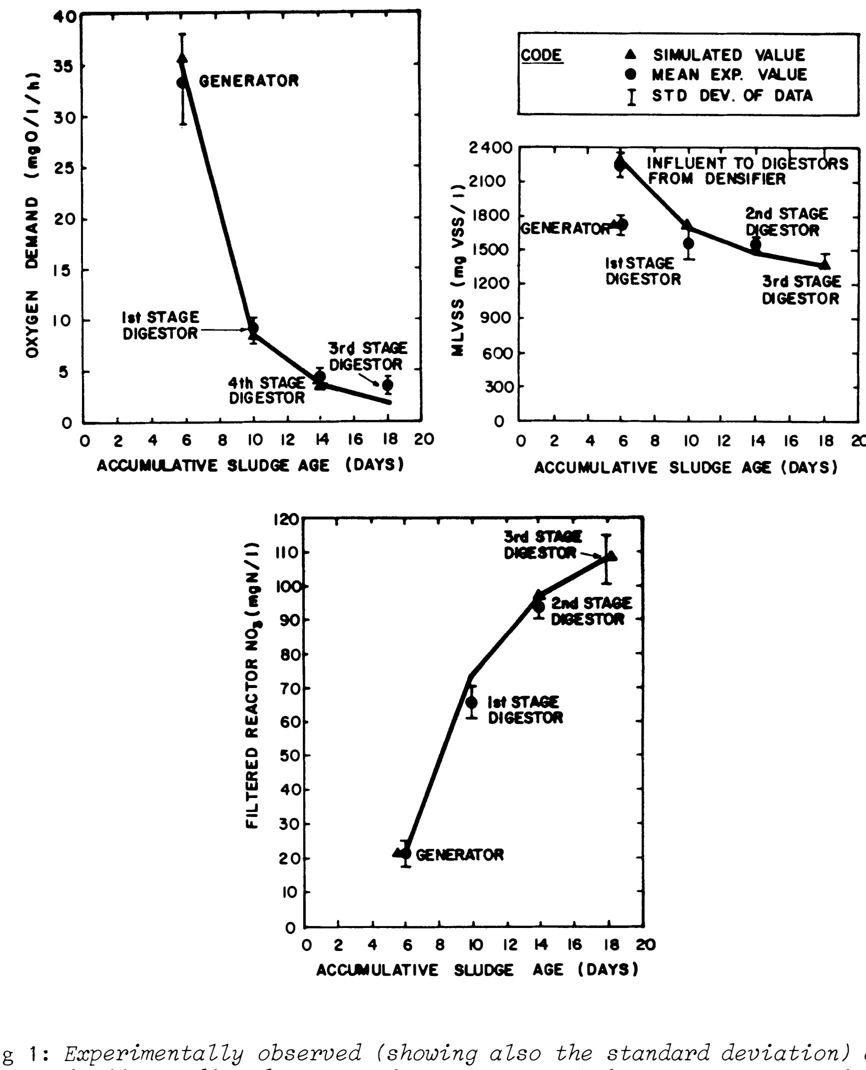

Fig 1: *Experimentally observed (showing also the standard deviation) and theoretically predicted progressive response of the oxygen consumption rate, reactor nitrate concentration and MLVSS concentration through the generator (activated sludge process at 6 days sludge age) and the 3 in-series aerobic digesters system (each 4 days sludge age). Temperature 20°C, pH 7,5.*

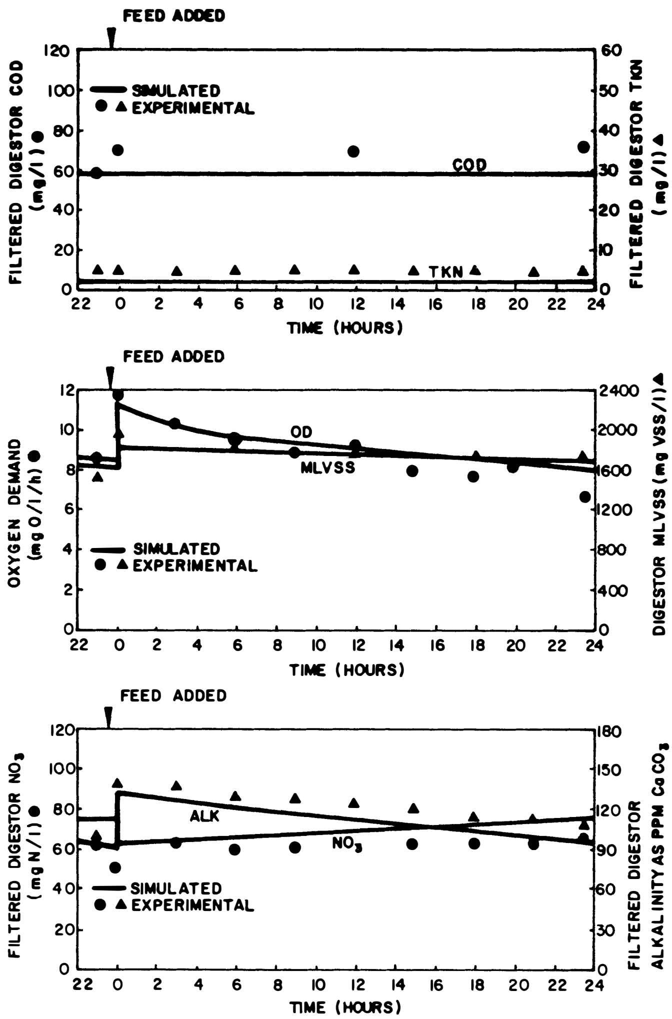

Fig 2: *Experimentally observed and theoretically predicted response in an aerobic digester (draw and fill) at 4 days sludge age receiving a daily slug of waste sludge from an activated sludge process treating raw municipal wastewater at 6 days sludge age. Temperature 20°C, pH 7,5.*

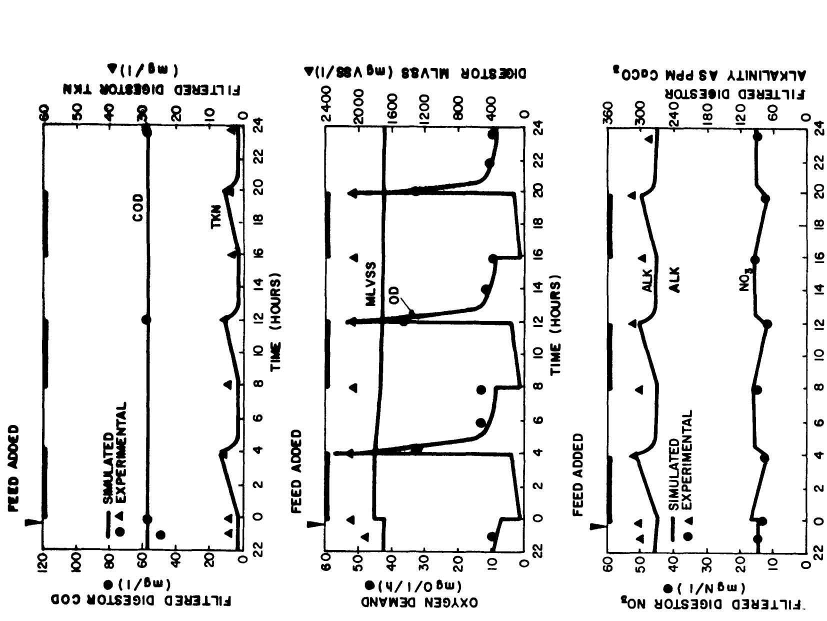

Fig 4: *Experimentally observed and theoretically predicted response in an anoxic-aerobic digester (draw and fill) at 4 days sludge age receiving a daily slug of waste sludge from an activated sludge process treating raw municipal wastewater at 6 days sludge age. Anoxic and aerobic cycles of 4 hours each. Temperature 20°C, pH 7,5.*

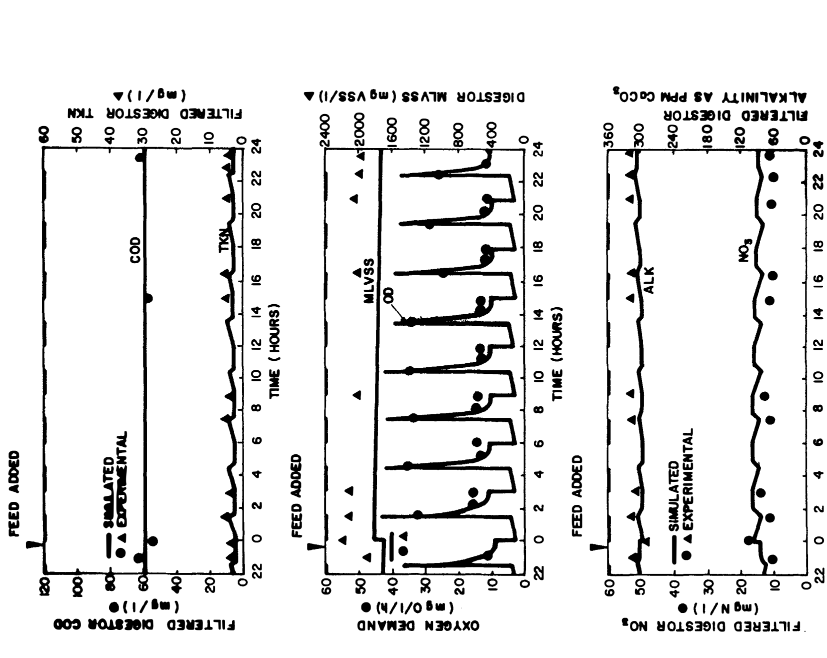

Fig 3: *Experimentally observed and theoretically predicted response in an anoxic-aerobic digester (draw and fill) at 4 days sludge age receiving a daily slug of waste sludge from an activated sludge process treating raw municipal wastewater at 6 days sludge age. Anoxic and aerobic cycles of 1,5 hours each. Temperature 20°C, pH 7,5.*