Waste Management
FACTSHEET

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FAN ENGINEERING MANURE SEPARATOR

Operation and Performance

The Hog Producers' Sustainable Farming Group sought new technology in manure separation equipment as part of our mandate to explore manure treatment methods. A new design of separator that had not been tested in Canada was the FAN Engineering press-screw or squeezer separator, designed and built in Germany. The group purchased a FAN separator in May, 1992 and tested it during 1992 and 1993. This factsheet summarizes operational requirements of the separator and its performance.

Separator Function

After slurry is pumped up to the separator, the first stage of separation is achieved by gravity, as the slurry flows through a cylindrical 'wedge wire' screen and the cleaner liquid flows away, leaving a concentrated slurry on the screen. Different sizes of screen are available; we tested a 0.75 mm (0.03 in) and 0.50 mm (0.02 in) screen for hog manure and found the 0.50 mm screen to be more effective. The concentrated slurry is then pushed by a screw auger towards the mouthpiece of the separator. The pressure created by the build-up of solids causes further liquid to be squeezed out of the matrix prior to it being pushed out of the separator. A plug of manure solids, which acts as the squeezer, forms in the mouthpiece of the separator. The separator is equipped with a vibration system to increase the flow rate and improve squeezing action when separating difficult slurries.

The separator has an electrical power requirement of 3.0 kW (2.25 hp) and is supplied from a 460 volt 3-phase line. The machine can also be powered from 380 or 220-volt 3-phase lines after rewiring. Screw speed is 30 rpm. The machine weighs approximately 260 kg (580 lb) with a dimension of about 2.1 m x 0.6 m x 1 m (6.9 ft x 2.0 ft x 3.3 ft).

Effect of Solids Content of Slurry On Separator Function

We found that the FAN separator did not function well with dilute hog slurries (less than 3% solids), but did work fine if thin slurries were pre-concentrated before separation. In thin slurry, there are not enough large particles to form the plug, therefore the fine particles accumulate, and eventually block, the opening of the screen which stops the separator. Most hog slurries from flush and shallow gutter systems have less than 3% solids, especially if they are stored uncovered. Manure stored in below-barn pits or in covered storages should contain more than 4% solids; the FAN separator will work well with these slurries without pre-concentration.

Two pre-concentration methods where tested and satisfactory results were achieved with each one.

a. Pre-concentration through an inclined screen: the screen was mounted on a rigid frame over a catch tank. Manure was flushed into the catch tank and was pumped onto the screen. The separated liquid was directed into long-term storage and flush liquid was drawn out of this tank. The concentrated slurry dropped back into the catch tank. Once the slurry level dropped to 3 feet above the bottom of the catch tank, a float switch deactivated the pump. Several days of manure production were pre-concentrated in the catch tank, and the FAN separator was run only once or twice per week.

With pre-concentration, the slurry in the catch tank had around 6% solids, ideal for the FAN separator, and the separated liquid had about 2% total solids.

b. Pre-concentration with a settling tank: slurry was first flushed into a catch tank and settled for 2 to 3 hours, after which a transfer pump suspended 2 feet above the bottom of the tank pumped the supernatant to a long-term storage tank. The thickened slurry in the catch tank had a total solids concentration of about 6%, ideal for the FAN separator. The supernatant had about 0.8% solids consistently. Slurry was pre-concentrated for several days before running the separator.

Other Management Tips for the FAN Separator

Weight of the mouthpiece: it was found that when extra weight was loaded on the mouthpiece, the processing rate could be increased by about 20%.

Overflow: should be kept to a minimum. If overflow is too high, the fast flowing stream will cause suction which stops the flow of manure into the separator.

Quality of the slurry: the type or fineness of grind of feed did not significantly impact the function of the separator. The total solids content of the slurry was the factor that most affected separator function.

Performance of the FAN Separator

Table 1 lists removal of solids and nutrients from hog slurry with the separator. With the 0.5 mm screen and manure with 5% solids content, the separator was able to remove 79% of solids, 83% of total suspended solids, 17% of nitrogen, and less than 10% of phosphorus and potassium. The separator was able to process up to 30 cubic metres of manure per hour, and would produce up to 3 tonnes of solids per hour from manure with 5% solids. The separated solids contained about 73% moisture, and had a carbon nitrogen ratio of 32:1 and a pH of 7.9. These qualities, along with the coarse texture, make the solids ideal for composting with no added bulking agent.

Provided that the manure to be separated has at least 4% solids, the FAN separator works very efficiently and requires little maintenance or repairs. With pre-concentration, problems with dilute slurries can be overcome. The FAN separator costs in the range of $30,000.00 Cdn. (1993).

Table 1 Removal of Solids and Nutrients from Slurry by FAN Separator

	Influent concentration mg/L*	Effluent concentration mg/L	Removal-range %	Removal-avg. %
Total solids	5.4 - 5.8	0.8 - 1.4	74 - 86	79
Total suspended. solids	4.5 - 5.4	0.6 - 1.0	82 - 88	83
COD**	37706 - 40324	10568 - 21491	43.8 - 73.4	57.6
Ammonia	1534 - 2148	2138 - 1532	0 - 6.7	1.9
Total nitrogen	2338 - 2920	1905 - 2427	3.3 - 28.6	17.5
Dissolved phosphorus	251 - 428	230 - 411	1.7 - 19.3	8.6
Potassium	881 - 941	760 - 868	5.0 - 19.2	9.7
Salinity	10.1 - 13.2	9.9 - 12.6	1.9 - 17.5	7.7

* all influent and effluent data in mg/L except total solids and total suspended solids which are in %

** Chemical Oxygen Demand

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