VIROTEC
Global Solutions

A COMMERCIAL APPLICATION OF
VIROSEWAGE™ TECHNOLOGY

CASE STUDY
THE NADA DAIRY FARM
SAUDI ARABIA

ViroCompost™ Technology also showed that the available raw material feedstock could be composted at a low cost, in a short time and without production of objectionable odours and that a marketable end product could be produced.

The NADA Dairy Farm in Al-Hofuf

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PROBLEM

The NADA Dairy Farm in Al-Hofuf generates about 34,000 tonnes of organic wastes per year and is one of the largest dairy farms in Saudi Arabia. Virotec Global Solutions was commissioned to demonstrate ViroCompost™ Technology was a viable option for the NADA Dairy Farm, and to show the beneficial effects that ViroBlend™ reagent has on the composting process and the final compost product.

Waste from the dairy farm

VIROTEC TOTAL SOLUTION

Virotec successfully implemented ViroCompost™ Technology to turn dairy farm waste into a valuable end product that could be beneficially re-used, or sold. The key objective was to produce a high quality compost product in a short time frame with minimal costs.

BACKGROUND

The NADA Dairy Farm in Al-Hofuf is one of the largest dairy enterprises in the Kingdom of Saudi Arabia. Currently, the farm accommodates about 12,000 milking cows and 3,000 replacement stock. The farm generates over 40,000 cubic meters (m^3) of manure per year, plus various other organic wastes, including: left over feed, residues from the on-site wastewater treatment plant, and green vegetation waste (Table 1). In total, more than 50,000 cubic meters (m^3) or 34,000 tonnes (T) of organic residues are generated annually at the farm. About three quarters of the residue is manure + sand and the rest (about 14,000 m^3 or 9,000 T) is made up of various other organic residues.

NADA Dairy Farm ("NADA") is considering options for value-adding and finding beneficial uses for their waste organic residues, including an option to compost the generated manure and other organic residues.

TABLE 1: ESTIMATED QUANTITY OF ORGANIC RESIDUES THAT MAY BE AVAILABLE FOR COMPOSTING

Material	Volume (m^3 / year)	% Volume	Mass (T / year)	% Mass
Dairy Cattle Manure				
Pure Manure	ca 4,900	9.38	3,430	10.09
Manure + Sand	38,461	73.62	25,000	73.56
WWTP Solids				
Particulate Matter	1,000	1.91	850	2.50
Primary Settling Basin Sludge	2,500 (1,000 if delivered once a year)	4.79	2,250 (900 if delivered once a year)	6.62
Dry Secondary Sludge	180	0.34	90	0.26
Leftover Feed	4,000	8.45	2,000	6.45
Vegetation Residues	1,200	2.54	365	1.18
Total	52,241	100.00	33,985	100.00
Total without Manure + Sand	13,780		8,985	

TREATMENT DETAILS

The composting operations involved blending the raw material feedstock to produce three grades of compost (Table 2); the mixes roughly reflect the proportions of each component generated on
the farm.

ViroBlend™ reagent mixed with the waste product

The addition of ViroBlend™ reagent optimises conditions for the production of high-grade compost in the shortest possible time using the best available composting know-how and technology. The appropriate quantities of ViroBlend™ reagent were added to each of the mixes listed in Table 2. Despite the extreme hot weather conditions at the NADA site and high evaporation rates during the day, it was noted that water-holding capacity of the mixes was much higher after treatment with ViroBlend™ reagent; this benefit has also been noted in previous Australian trials using ViroBlend™ reagent. The compost produced using the ViroBlend™ reagent was also found to have an enhanced water-holding capacity, which is important where scarce water resources are used for irrigation.

TABLE 2: AMOUNT OF RAW MATERIALS USED FOR PRE-MIXING THE MAIN FEEDSTOCK

Code	Main Feedstock Material	Raw Material Component	Volume (m^3)	Volume %
A	Manure + Sand	Manure + Sand	126	87.50
		Leftover Feed	15	10.42
		Vegetation Residue	3	2.08
	Total		144	100.00
B	Pure Manure	Pure Manure	70.5	48.96
		Leftover Feed	70.5	48.96
		Vegetation Residue	3	2.08
	Total		144	100.00
C	Primary Sludge	Primary Sludge	33	42.31
		Leftover Feed	33	42.31
		Particulate Matter	9	11.54
		Vegetation Residue	3	3.85
	Total		78	100.00

Composting stabilises organic matter, yielding a final product that contains humus and essential plant nutrients and has a uniform crumbly texture. Because the composting process consumes water and produces heat, which increases evaporation from the material, the increased water retention in the ViroBlend™ reagent treated material reduces the need to add water during composting.

The ViroBlend™ reagent was mixed with the premixed feedstock materials and composting rates, temperature and moisture levels were monitored regularly during the trial. Composite samples from each pile were analysed at regular intervals during the trial for moisture at the NADA laboratory and it was found that the ViroBlend™ reagent substantially increased the water-holding capacity; this effect is particularly important where water resources are scarce because water is a key ingredient in the composting process.

Mixing of the ViroBlend™ reagent into the waste product

RESULTS

The results show that using ViroBlend™ reagent as part of the composting process greatly improved the moisture content and water holding capacity of the compost (Table 3). Furthermore, ViroBlend™ reagent enhanced microbiologic activity and shortened the time needed to produce compost that can either be used on the NADA Dairy Farm or sold. ViroCompost™ Technology was successful in producing pasteurised compost in six weeks and greatly reduced objectionable odours commonly associated with composting.

ViroCompost™ Technology provides a unique combination of engineering design, know-how, equipment, and an environmentally benign inorganic reagent called ViroBlend™ reagent to control odour, decrease composting times, and improve the quality of compost products.

TABLE 3: CHARACTERISTICS OF SIX-WEEK-OLD COMPOST PRODUCTS

Characteristic	Unit	Manure + Sand		Pure Manure		Primary Sludge
Turning		Weekly	Fortnightly	Weekly	Fortnightly	Fortnightly
Moisture	% FM	37.51	38.04	42.72	30.86	39.47
Bulk Density	kg/L	1.02	1.14	1.04	1.04	0.96
pH	-	7.71	8.06	7.86	7.59	7.03
EC	dS/m	19.19	18.88	17.74	17.43	17.25
Organic Matter	% DM	26.53	13.23	17.98	19.19	19.59
Organic Carbon	% DM	15.61	7.78	10.58	11.29	11.52
Total Nitrogen	% DM	0.84	0.82	0.89	0.91	1.05
C/N Ratio	-	18.58	9.49	11.89	12.41	10.97
Salmonella sps	cfu/25g	absent	absent	absent	absent	absent
Faecal Coliform	cfu/g	40	120	88	200	480
e.Coli	cfu/g	4	<4	32	36	8

The generated compost products contained nitrogen and other macro nutrients (phosphorus, potassium, magnesium and calcium) as well as trace elements such as copper, manganese, zinc and iron (Tables 4 and 5), all of which are essential for healthy plant growth and soil fertility.

ViroCompost™ Technology is a viable option for processing, stabilising and pasteurising all organic residues generated at the NADA Dairy Farm, and turning them into valuable compost products. ViroCompost™ Technology produced compost that can be used on NADA's own land or marketed to other farmers. This compost is an excellent additive to supply nutrients and improve soil fertility.

TABLE 4: CHARACTERISTICS OF 12-WEEK-OLD COMPOST PRODUCTS (NADA LAB)

Characteristic	Unit	Manure + Sand		Pure Manure		Primary Sludge
Turning		Weekly	Fortnightly	Weekly	Fortnightly	Fortnightly
Moisture	% FM	22.48	26.58	28.74	28.56	26.52
pH		8.92	8.89	8.56	8.36	8.10
EC	dS/m	11.82	11.11	10.55	10.86	10.24
Organic Matter	% DM	18.99	16.53	11.76	15.00	15.45
Organic Carbon	% DM	11.17	9.72	6.92	8.82	9.09
Total Nitrogen	% DM	0.68	0.62	0.52	0.55	0.72
Nitrate	% DM	0.02	0.02	0.04	0.06	0.04
C/N Ratio	-	16.43	15.68	13.30	16.04	12.62
Phosphate	% DM	0.41	0.41	0.22	0.34	0.28
Potassium	% DM	1.33	1.26	0.75	0.80	0.56
Calcium	% DM	2.92	2.74	2.68	2.34	2.54
Magnesium	% DM	0.36	0.33	0.30	0.29	0.28
Sulfate	% DM	0.30	0.36	0.61	0.71	0.44
Sodium	% DM	0.52	0.51	0.36	0.36	0.25
Chloride	% DM	1.40	1.28	1.17	1.21	0.68
Copper	ppm	75.41	65.26	84.93	92.55	121.59
Manganese	ppm	107.54	102.76	75.10	76.29	76.60
Zinc	ppm	88.68	84.00	64.55	65.55	68.52
Iron	ppm	858.47	789.83	791.64	756.86	815.70
Salmonella sps.	cfu/25g	<1	<1	>1,000	<1	<1
Faecal Coliform	cfu/g	>10,000	>10,000	>10,000	>10,000	>10,000
E.coli	cfu/g	<1	<1	<1	<1	<1

Note for Table 4: Organic matter levels determined through loss on ignition; conversion factor for organic carbon: 1.7; no correction for inorganic carbon content

TABLE 5: RATIO OF MAJOR NUTRIENTS IN COMPOST PRODUCTS

Element	Manure + Sand		Pure Manure		Primary Sludge
	Weekly	Fortnightly	Weekly	Fortnightly	Fortnightly
Nitrogen	1.00	1.00	1.00	1.00	1.00
Phosphorus	0.60	0.66	0.42	0.62	0.39
Potassium	1.96	2.03	1.44	1.45	0.78
Magnesium	0.53	0.53	0.58	0.53	0.39

CONCLUSION

ViroCompost™ Technology successfully met the goals set for the project and enabled the production of high quality compost suitable for reuse at the NADA Dairy Farm or sale to other farms.

ViroCompost™ Technology also showed that the available raw material feedstock could be composted at a low cost, in a short time and without production of objectionable odours and that a marketable end product could be produced.

ViroCompost™ Technology successfully turned a waste into a marketable product that the dairy farm can use to make a profit for their business.

Saleable pasteurised compost prepared using ViroBlend™ reagent

689/MKT/11 03.10.11