This Indian Poultry Farm Runs On Methane

• At Papcock Farm, Baroda, India, we have been producing methane gas successfully from poultry manure since 1963. In addition we have been producing bio-fertiliser from the sludge and using it on about 30 hectares of agricultural land. Our laying flock has been increased from 500 to 2000 layers. With the high cost of feed and other expenses, it would be difficult to make our egg operation profitable if it were not for our methane farming activities.

The poultry manure from under the cages, wastes from the incubator and brooders, and dead birds are all placed in a receiving tank and mixed with water before being fed into a specially designed digester.

Into Liquid And Gas

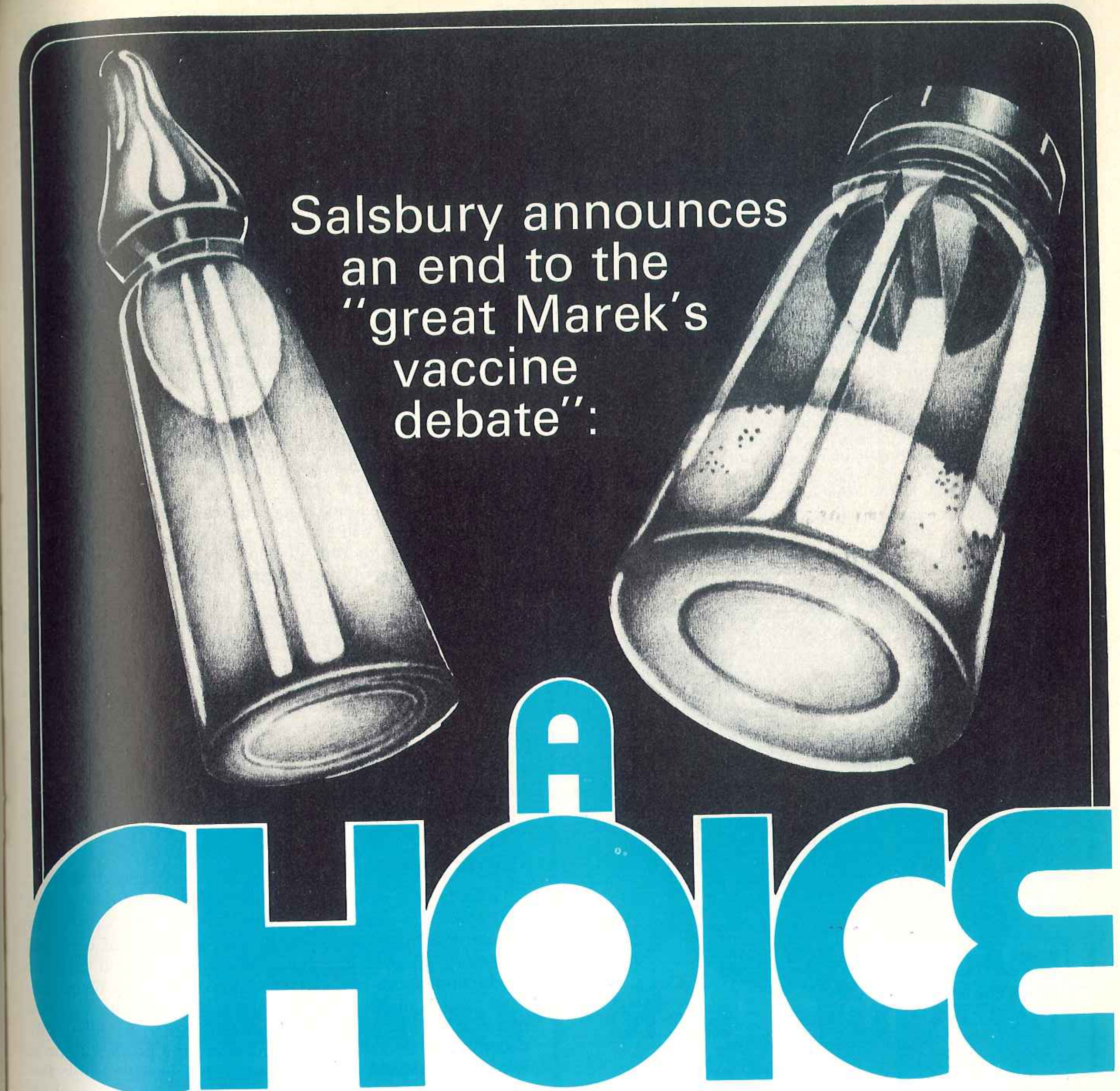
In the digester, the manure and other wastes undergo two basic processes during digestion — liquefaction and gasification. Liquefaction occurs with extracellular enzymes which hydrolyse complex carbohydrates to simple sugars, proteins to peptides and amino acids, and fats to glycerol and fatty acids. The ultimate end products of the liquefaction process are primarily volatile organic acids which are produced by acid producing strains of bacteria. The acids are primarily acetic, butyric, and propionic.

During gasification, the products of liquefaction are further broken down to gaseous end products. The principal components of this gaseous mixture are carbon dioxide and methane. During a well-balanced digestion process, liquefaction and gasification occur simultaneously. The degree to which the various substances present in poultry manure will be decomposed depends on their chemical nature.

Gas from a well-balanced digested mixture will contain 25 to 35% carbon dioxide and 65 to 75% methane. The gas is collected in a holder which is suspended in the digester, and is used as a fuel to run the incubator with a capacity of 4224 eggs, brooders with a capacity of 2100 chicks, and a small gas engine for driving the feed mixer, incubator fans, and a generator. Large quantities of gas also are available for domestic cooking for a family of 40 people.

From poultry manure, heat, light, and power are generated with no extra labour other than the removal of manure from the cage plant. One cubic metre of methane gas contains 6000 calories. Our present installation produces about

The waste digester at Papcock Poultry Farms with its floating cover, gas pipe and release valve, and with a 2.1-volt battery for storing the bio-electricity which is generated.



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20 cubic metres of methane gas per day which is equivalent to 15 litres of kerosene costing over US $2 daily.

The gas can be stored in the gas holder and piped into the house to provide clean fuel for cooking, heating and lighting. It has a slight barnyard odour by which any leaks can be readily detected. It has a very low toxicity since it contains very little carbon monoxide — the toxic constituent of most city gas.

Methane burns with a violet flame without smoke. Since a considerable amount of carbon dioxide is mixed with the methane, the risk of fire or explosion is somewhat less than if city gas were used. However, every precaution should be taken to avoid obtaining a mixture of methane and air, except when the methane is burned as an open fire.

Temperate Climates

Small digester plants can be used most effectively in temperate climates where freezing temperatures are infrequent and of short duration. Decomposition and gas production are most rapid at about 35°C, but are satisfactory at temperatures above 15 to 20°C. The digester can be used satisfactorily in cold climates, provided the digester tank is properly insulated and heated.

During the digestion period, the rate of gas production in a batch operation will increase gradually at first, then will reach a maximum rate plateau, and finally will decrease when a large part of the material has undergone decomposition.

At higher temperatures, the rate of gas production will be greater and the digestion cycle will be shorter. The total amount of gas produced per ton of material in a cycle however will be approximately the same for temperatures from 15 to 35°C. At 15°C, the cycle would be about 12 months, while at 35°C, it would be about one month.

About 50% of the carbon theoretically available for gas production is converted into gas. A metric ton of waste normally will yield about 50-70 cubic metres of gas per digestion cycle, depending upon the type of organic matter and the carbon content of the waste.

Care Is Called For

Considerable care must be taken in putting the digester into operation. Until conditions have become satisfactory for the growth of large numbers of the types of organism necessary for good anaerobic decomposition and methane production, there is a danger of too much acid formation. This retards digestion and inhibits gas production. When first starting the digester, material which has been partly decomposed by aerobic fermentation for a period of one to two weeks should be introduced. This initial aerobic fermentation will eliminate some of the components which may cause production of acids.

After loading, the material should be allowed to ferment aerobically for a further period of about three days to develop a high temperature. If available, it is best to add some digested humus and liquid from another plant which has been in operation and producing gas for some time. The remaining volume of the digester is then filled with water.

After the tank has been sealed to provide anaerobic conditions, the material will undergo a maturing period of several days before gas production starts. If the initial material is not satisfactorily decomposed and seeding from another tank is not possible, acid conditions can develop and it may be a month or more before the conditions become favourable for gas production. The addition of an alkali or ammonium phosphate will help to correct an acid condition and facilitate gas production.

The digester is emptied by removing the decomposed material from the bottom through the outlet pipe. Special attention must be paid to not smoking, lighting matches, or creating sparks, which would ignite the gas in the digester when it is first opened. After the gas has been completely diluted in

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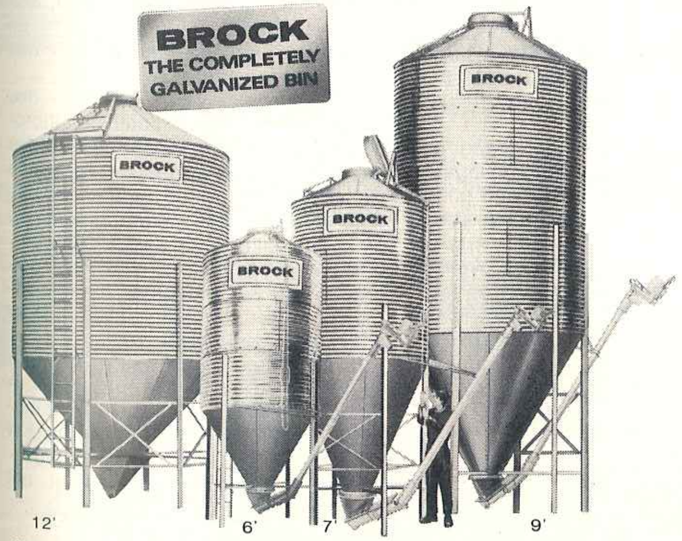

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air, there is no danger of ignition or explosion.

In case of reloading the digester with fresh material through an inlet pipe, gas production will start quite soon because of the digested humus and liquid which were left in the tank. While loading or unloading the digester, we have not experienced any danger of ignition or explosion because we use a floating cover with a centre guide on our digester instead of a fixed cover. This minimises the danger since excess gas escapes through the centre guide.

About half of the digested liquid should be left in the digester to provide seeding for the next load. The digested liquid from the tank is either diverted to a municipal sewer or to our 30-cm deep algae ponds where it is mixed with blue green algae and dried. We have observed that digested poultry manure is the best growing medium for algae because of its low content of nitrogen and other nutrients present in the digested effluent.

Excellent Fertiliser

The algal protein sludge produced by photosynthetic activity has been applied to our 30 hectares of land. It has done wonders in vegetable gardens, orchards, and agricultural

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Questo allevamento indiano funziona con metano

Riassunto—L'allevamento Papcock, Baroda—India—ha ricavato con successo metano da sterco di polli fin dal 1963. Inoltre sono stati adoperati concimi naturali derivanti da liquame su circa 30 ettari di campo agricolo.

Lo sterco di polli, preso da sotto le gabbie, l'immondizia dell'incubatoio ed animali morti vengono tutti messi in una cisterna e mescolati con acqua prima di essere condotti verso un digestore ideato specialmente per questo fine.

Il gas viene raccolto in un contenitore che si trova nel digestore e serve da carburante per l'incubatrice con una capacità di 4224 uova, per le chioccie con una capacità di 2100 pulcini e per una macchina a gas della mescolatrice, per i ventilatori dell'incubatrice e per una generatrice. Resta ancora una grande quantità di gas, sufficiente per la cucina di una famiglia di 40 persone.

Basta soltanto togliere lo sterco dalle gabbie per ottenere riscaldamento, illuminazione ed elettricità, provvenienti dagli escrementi. Un metro cubo di gas metano contiene 6000 calorie. L'installazione in questione produce quasi 20 metri cubi di gas metano, il che equivale a 15 litri di carburante ad un prezzo di più di 2 dollari al giorno.

Circa la metà del liquido fermentato rimane nel digestore per avviare il processo del carico seguente. Il liquido rimasto nella cisterna viene condotto verso la fognatura municipale oppure verso uno stagno con una profondità di 30 cm., dove viene mescolato con alghe ed asciugato.

La sostanza proteica a base di alghe, prodotta dall'attività fotosintetica, é stata usata per orti, albereti ed altri scopi agricoli. Le varie raccolte sono aumentate con il 200%. Tutto il residuo ammonta a 40-50% di circa 80 tonnellate di immondizie, originalmente usate per la fermentazione; questo residuo viene utilizzato oppure venduto a 65 dollari la tonnellata.

Il digestore é anche una fonte di bioelettricità che é stata accumulata in una cellula con voltaggio 2,1. Questa energia nasce dal digestore con un voltaggio di 1,5 e viene utilizzato per l'illuminazione.

Indische Gelfügelfarm arbeitet mit Methan-Treibstoff

Zusammenfassung—Die Papcock Farm in Baroda, Indien, hat seit 1963 mit Erfolg Methangas aus Geflügelkot erzeugt. Ausserdem wird biologischer Kunstdünger aus dem Kotschlamm auf ca. 30 ha landwirtschaftlicher Nutzfläche eingesetzt.

Käfigkot, Brüterei- und Kükenaufzuchtsabfälle und Tierkadaver kommen in einen Auffangtank und werden dort vor Weiterbeförderung in einen Spezial-Zersetzungsbehälter (Digester) mit Wasser vermischt.

Das Gas sammelt sich in einem im Digester hängenden Haltbehälter an und wird als Brennstoff für den Vorbrüter mit einer Kapazität von 4224 Eiplätzen, für die Gasglucken für 2100 Küken and für einen kleinen Gasmotor, der die Futtermischmaschine, die Brutmaschinenventilatoren und einen Generator treibt, eingesetzt. Des weiteren wird das erzeugte Gas an ca. 40 Familien als Herdgas geliefert.

Aus dem Geflügelkot werden also Wärme, Licht und Strom erzeugt, ohne dass dies, vom Ausbringen des Kotes aus dem Stall abgesehen, zusätzliche Arbeit erfordert. 1 cbm Methangas enthält 6000 Kalorien. Die gegenwärtig vorhandene Installation produziert täglich ca. 20 cbm Methangas, entsprechend ca. 15 1 Kerosin zum Preis von US $ 2,00.

Ungefähr die Hälfte der zersetzten Flüssigkeit bleibt im Digester als Ausgangsmedium für die nächste Charge. Die zersetzte Flüssigkeit aus dem Tank wird entweder in die örtliche Kanalisation oder in 30cm tiefe Algenteiche geleitet. In letzteren erfolgt Vermischung mit blaugrünen Algen und nachfolgend Trocknung.

Der durch Fotosynthese entstehende Algen-Proteinschlamm ist als Dünger für Gemüseanbauten, Obstgärten und Ackerfrüchte eingesetzt worden. Die Erträge bei verschiedenen Fruchtarten konnten dadurch um 200% gesteigert werden. Die gesamte Rückstandsmenge beläuft sich auf ca. 40 - 50% von rund 80 t ursprünglichem Abfallmaterial, das der Verarbeitungsanlage aufgegeben wurde. Diese Verarbeitungsrückstände werden entweder im Eigengebrauch verwendet oder für $65 die t verkauft.

Der Digester liefert auch Bio-Elektrizität, die in einer 2,1 Volt Speicherzelle erzeugt wird. Diese Energie wird kontinuierlich mit einer Leistung von 1,5 Volt produziert und für Beleuchtungszwecke eingesetzt.

Cette ferme Indienne de volailles marche au méthane.

Sommaire—La ferme Papcock, Baroda, Indes, a produit du gaz méthane avec du fumier de poules avec succès depuis 1963. En plus ‚du bio-fertilisateur des résidu est employé sur a peu près 30 hectares de terre agricole.

Le fumier des poules d'en dessous des cages, les déchets des incubateurs et des couveuses et des bêtes mortes sont placés dans un réservoir et mélangés avec de l'eau avant d'être introduit dans un digestateur spécialement désigné. Le gaz recueilli dans un récipient qui est suspendu dans le digestateur, et qui est employé comme fuel pour faire marcher l'incubateur d'une capacité de 4.224 oeufs, couveuse d'une capacité de 2.100 poussins, et un petit moteur a gaz qui fait marcher le melangeur de nouriture, les ventilateurs des incubateurs et un générateur. De grandes quantités de gaz sont également employeés pour la cuisine de 40 personnes. Chaleur, lumière et force sont produites sans travail autre que le déplacement du fumier des cages. Un mètre cubique de gaz méthane contient 6.000 calories. L'installation actuelle produit a peu près 20 mètres cubique de gaz méthane par jour ce qui est équivalant a 15 litres de kérosene coutant plus de 2 Dollars americain par jour.

A peu près la moitié du liquide digéré est laissé dans le digestateur pour fournir le chargement prochain d'une base. Le liquide digéré du tank est soit digéré vers un égout municipal, soit vers des étangs d'algues de 30cm de profondeur ou il est mélangé avec des algues bleue verte et séché.

La substance de protéine des algues, produite par l'activité photosynthétique, a été répandue sur des jardins de légumes, des vergés et des récoltes agricoles. Le rendement des différentes récoltes a été augmenté de 200%. L'entierreté du résidu est a peu près de 40 a50% provenant d'a peu près 80 tonnes de déchets du digestateur, ce qui est soit employé soit vendu a 65 Dollars americain par tonne.

Le digestateur est également une source de bioélectricité, qui est accumulée dans une cellule d'emmagasinement de 2.1 volt. Cette énergie est produite continuellement par le digestateur au taux de 1.5 volt, et est employé pour l'éclairage.

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crops. Yields of various crops have been increased 200%. These values are difficult to evaluate in gross returns and are often ignored in considering the anaerobic system.

The entire residue amounts to about 40 to 50% of about 80 tons of wastes originally used for digestion, which is either used or marketed at $65 per ton.

The digester is also a source of bio-electricity. We have been able to accumulate this energy in a 2.1 volt storage cell. We have observed that bio-electrical energy is produced continuously from the digester at a rate of 1.5 volts which was used to charge a 2.1 volt storage battery. The stored energy is used for lighting purposes.

Our results of collecting bio-electricity have been most encouraging. We hope by adding some suitable chemicals in the digester, we can increase the voltage to more than 4 volts. We are working on this. In due course of time, we hope we can throw more light on this new subject.— *H.B. and J.D. Patel*

An End To Fat Chickens

Obesity in commercial layers can be controlled by manipulating their diet before they reach egg production, say American researchers. If chicks are reared on a low-energy diet, they do not later become fat even when fed higher energy.

At Cornell University, chicks were given a feed low in energy from the day after hatching until the time, 22 weeks later, that they came into lay. On maturity, they were offered normal diets.

Compared with conventionally reared birds, this treatment reduced the total fat in the experimental layers by about 23% on average. The size of the abdominal fat pad, a major site of fat storage in laying hens, was down by 50%. Throughout egg production, these hens did not become obese and continued to maintain less fat in their bodies.

It was found that their fat cells remained as small as they had been during the growing period, indicating that fat was not accumulating excessively. Also, the number of fat cells increased to a certain point, but there was little further increase in number after the birds became adults.

If these results mean that allowing young stock fewer calories has a permanent effect on fat accumulation in later life, the Cornell team point out, they could have important implications for humans as well as for hens. In layers, it may be possible to prevent obesity in caged birds and thus cut the incidence of fatty liver haemorrhagic syndrome — the liver disease associated with fatness.

Fuel Costs Hit Manure Drying

Current fuel costs for drying poultry manure in Britain seem to rule out the use of the dried product as a fertiliser, and suggest that it could be recycled more profitably in animal feed.

At the ARC poultry research centre in Edinburgh, Scotland, drying normal battery manure at 75-80% moisture has been estimated to cost £ 22 per ton for fuel alone. But nutrient analysis of the dried waste calculated its fertiliser value at only £ 14.70 per ton.

As a feed ingredient, dried waste from layers contains similar levels of true protein and amino acids to barley, its ash is high and it includes about 7% calcium and 2% phosphorus. Levels of up to 20% have been included in layers' rations with no loss of production.

However, dried waste is also low in energy, having only about 850 kcal per kilo. In order to maintain the energy status of the diet, therefore, it is sometimes necessary to add fat. If this is done, up to 10% can be included in broiler rations without depressing growth.

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