



**FEDERAL REPUBLIC OF NIGERIA**  
*Patents and Designs Act,*  
 (CAP 344 LFN 1990)

16646

PATENT NO:.....

RP:.....

Date of Patent: 14/11/2006

Date of Sealing: 29/11/2006

President of the Federal Republic of Nigeria and Commander-in-Chief of the Armed Forces  
 OLUSEGUN OBASANJO

WHEREAS a request for the grant of a patent has been made by:

- (1) PROFESSOR MYNEPALLI K.C. SRIDHAR, (2) PROFESSOR GIDEON A. ADEOYE
- (3) DR. DAVID A. FADARE (4) PROFESSOR OLUFEMI O. BAMIRO., of
- University of Ibadan, Ibadan, Oyo State.

for the sole use and advantage of an invention for:

"ORGANIC AND ORGANO-MINERAL FERTILIZERS FROM WASTES"

WHEREAS the Federal Government being willing to encourage all inventions which may be for the public good, is pleased to accede to the request:

I DO, THEREFORE, that I do by this instrument give and grant unto the person(s) above named or any successor(s), executor(s), administrator(s) and assign(s) (each and any of whom are hereinafter referred to as the patentee) by special licence, full power, sole privilege, and authority, that the patentee or any agent or licensee of the patentee may subject to the conditions and provisions prescribed by any statute or order for the time being in force at all times hereafter during the term of the said invention herein mentioned make, use, exercise and vend the said invention throughout the Federal Republic of Nigeria, and that the patentee shall have and enjoy the whole profit and advantage from the said invention accruing by reason of the said invention during the term of twenty years from the date first written of this instrument: AND to the end that the patentee may have and enjoy the sole use and the full benefit of the said invention, I do by this instrument strictly command all citizens of the Federal Republic of Nigeria that they do not at any time during the continuance of the said term directly or indirectly make use of or put in practise the said invention, nor in anywise imitate it without the written consent, licence or agreement of the patentee, on pain of incurring such penalties as may be justly inflicted on such offenders, and of being answerable to the patentee in law for damages thereby occasioned:

PROVIDED ALWAYS that this patent shall be revocable on any of the grounds from time to time prescribed as grounds for revoking patents by me, and the same may be revoked and made void accordingly:

PROVIDED ALSO that nothing herein contained shall prevent the granting of licences in such manner and for such considerations as they may by law be granted.

MADE this 14<sup>th</sup> day of Feb.



# Patent No. 2

Federal Republic of Nigeria

Patent No.: RP: 16646

Date of Patent: 14 November 2006

Sridhar et al.

Date of sealing: 29 November 2006

**Title:** Organic and Organo-mineral Fertilizer from Wastes  
**Inventors:** Professor Sridhar, M.K.C; Professor Adeoye, G.A.; Dr. Fadare, D.A. and Professor Bamiro, O.A., all of University of Ibadan, Ibadan, Nigeria

## Summary

Solid waste and soil fertility management constitute two critical problems faced by many urban cities in developing countries. Ibadan, one of the urban centres in South-western Nigeria, the second largest city after Cairo in the Sub-Saharan Africa, with an average rate of solid waste generation of 0.39 kg per capital per day, consisting of 70.1%, municipal wastes; 18.8%, industrial wastes; 9.7%, institutional wastes; 0.7%, others, generates a total of 760 metric tonnes of solid waste per year. The astronomical rate at which solid waste is being generated exceeds the rate of storage, collection, transportation, and disposal. Thus resulting to accumulation of the wastes alongside major streets causing traffic disruption, filthy environs, blockage of drainage system leading to flood coupled with other associated environmental hazards. On the other hand, the average annual fertilizer usage of 12.8 kg/hectare in Nigeria is very low compared with Zimbabwe with 57.1kg and Western Europe with 231.4kg per hectare. This has led to poor farm management practices with attendant poor crop yield, food insecurity and poverty in the country. The search for sustainable solutions to these problems has been the concern of many researchers over the years.

A multidisciplinary research team drawn from three departments of the University of Ibadan: Mechanical Engineering, Agronomy, and Public Health and Preventive Medicine was constituted to develop a sustainable and indigenous technology for processing of solid waste into organic-based fertilizers.

The research effort of the team has led to the invention of an indigenous processing technology for conversion of solid waste to organic-based fertilizer in both powdered and pelletised forms. A ten (10) tons/day capacity organic fertilizer processing plant sponsored by the Oyo State Government was designed, constructed and installed at Bodija market. About 35 - 50 tons of market refuse and abattoir waste generated within the market are processed daily into organic fertilizer. The basic unit operations of the plant are: collection and transportation, sorting, shredding, composting, curing, drying, screening, pulverising, mixing and fortification, pelleting, and bagging. The process flow chart of the plant is shown in Figure 1.

The seven major unit operations including: shredding, drying, screening, pulverizing, mixing, pelletising and bagging were mechanised. The required machines: shredder, dryer, sorter, pulveriser, mixer, pelletiser, and bagger were designed and fabricated using locally sourced materials at the Faculty of Technology, University of Ibadan. Figure 2 shows the optimised plant design for the organo-mineral fertilizer production.

The University of Ibadan has won the National Merit Award of the Ministry of Science and Technology when the project was exhibited at the TECHNOEXPO 1996. In November 2002, the Bodija plant has won the United Nations/Dubai International Best Practices Award for improving the living environment (See Figure 3). This project has shown the way forward in generating wealth from wastes, environmental improvement, employment generation, food security and poverty alleviation. Various entrepreneurial skills have also sprung up around the project. Based on this developed technology, seven (7) other commercial plants of different production capacities have been developed, installed and currently in operation in different parts of the country:

- (1) The UI/RMRDC Organo-mineral Fertilizer Demonstration Plant at the University of Ibadan. Sponsored by the Raw Material Research and Development Council (RMRDC), Abuja.
- (2) The Sorting Centre/Organic Fertilizer Plant at Ayeye Community, Ibadan, Oyo State. Sponsored by UNICEF.
- (3) The Food waste Composting Plant at Forcados, Delta State. Sponsored by Shell Petroleum Development Corporation (SPDC).
- (4) The Pace Setter Integrated Waste Management Plant at Orita-Aperin, Ibadan, Oyo State. The second plant sponsored by the Oyo State Government.
- (5) The Sunrise Integrated Waste Management Plant at Akure, Ondo State. Sponsored by the Ondo State Government.
- (6) The Plastic/Nylon Recycling and Composting Plant at Aleshinloye Market, Ibadan, Oyo State. Sponsored by MTN Foundation.
- (7) The Solid Waste Composting Plant at Minna, Niger State. Sponsored by UNDP.

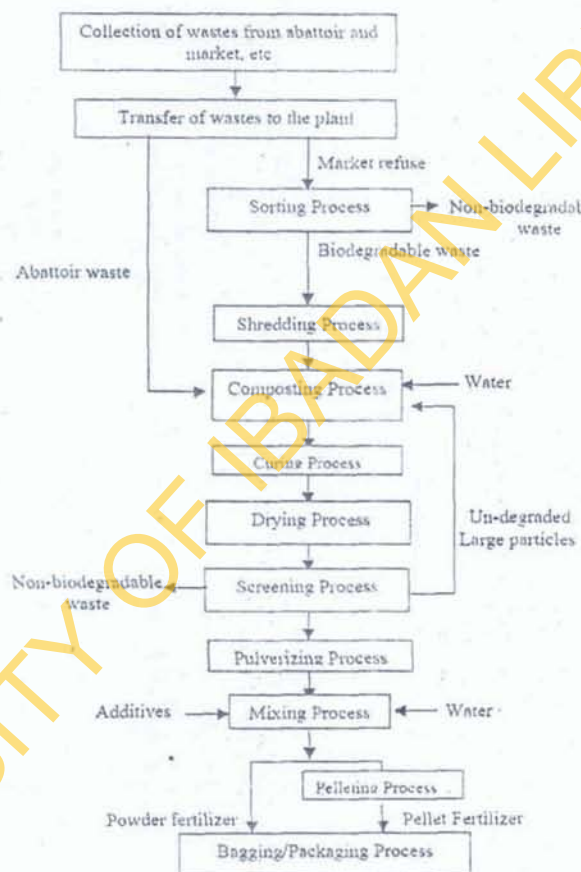


Fig. 1: Process flow chart of the plant

### Plant description

#### Collection and transportation of waste to the plant

About 30 - 40 tons of market refuse and 5- 10 tons of abattoir waste is processed daily in the plant. A tipping vehicle, owned by the State Government, is used to collect and transport the market refuse from the different dump sites located within the market to the plant. Because of the proximity of the slaughter house to the plant, wheel barrows are used to collect and transport the abattoir waste.



### **Sorting process**

The market refuse is heterogeneous with high bio-degradable components such as food waste, leaves, fruits, paper etc., constituting about 86.5 % by weight and 71% by volume. Sorting or segregation of the market refuse is done manually. The bio-degradable component is used for composting, while the non-degradable components such as iron, nylon, metal, glass are sold to respective recycling plants.

### **Shredding process**

In order to facilitate the rate of decomposition during the composting process, the market refuse with large particle sizes such as leaves, cartons of packaged products, fruits, paper etc. are shredded or grinded to smaller particle size. A mechanised shredding machine with 8 mm sieve, and a cutter rotating at speed of 2,800 rpm, powered with a 3-phase, high speed, 15 hp electric motor is used for the shredding process.

### **Composting, curing and drying processes**

The sorted bio-degradable component of the market refuse and abattoir waste are co-composted aerobically without inoculation of organisms at ratio of 3 to 1 respectively, inside open windrows for about 70 days. The heap is turned manually and sprinkled with water twice a week and samples are taken weekly for chemical analysis of the properties of the compost. After the maturation of the compost, the compost is cured for another 60 days and air dried for 3-5 days to reduce the moisture content before the processing is continued.

### **Screening process**

After composting and curing, the compost is screened mechanically with a separator with a sieve of 25 mm in order to remove large, undegraded part of the compost. The undegraded part is returned to the windrow and mixed with fresh compost, while the degraded part is conveyed via screen conveyor to the pulveriser. Other extraneous component like iron is removed by magnetic separator.

### **Pulverizing process**

The screened compost is then milled to fine powder using a hammer mill with a sieve size of 3 mm. The hammer mill is powered with a 3-phase 30hp high speed electric motor with an operational speed of 2,500 rpm.

### **Mixing and fortification processes**

The milled compost mixed with other mineral additives such as urea, rock phosphate and bone meal to produce the fortified fertilizer classified as grade A, while no fortification is added for grade B. For production of pellets for both grades A and B, Kaolin is also added as binding agent. Water is added generally to increase the moisture content to about 15% on wet basis before bagging of the powder fertilizer. The moisture content is increased to about 20% for the production of pellets.

### **Pelleting process**

The milled and fortified compost is compacted mechanically with an extrusion pelletiser into 10 mm cylindrical pellets. The extrusion temperature reduces the pellet moisture content to about 15% before it is bagged.

### **Bagging process**

The finished products (powder or pellet) are bagged in 50kg bags. The bags are underlaid with nylon to preserve the moisture content of the product.

Views of the Bodija Organo-mineral fertilizer Plant and the product are shown in Figures 4 -7.



**DUBAI INTERNATIONAL AWARD**  
FOR BEST PRACTICES TO IMPROVE THE LIVING ENVIRONMENT

*Best Practice Certificate*

*The United Nations Human Settlements Programme (UN-Habitat) and Dubai Municipality in the United Arab Emirates hereby certify that*

*Pace Setter Organic Fertilizer Project, Ibadan, Nigeria.*

*was selected as a Best Practice by an independent Technical Advisory Committee for the Dubai International Award for Best Practices in the year 2002 for its outstanding contribution towards improving the living environment*

QASSIM SULTAN  
DIRECTOR-GENERAL  
DUBAI MUNICIPALITY

ANNA KAJUMULO TIBALUKA  
EXECUTIVE DIRECTOR  
UN-HABITAT

ISSUED NOVEMBER 2002

Fig. 3: The United Nations/Dubai International Best Practices Award



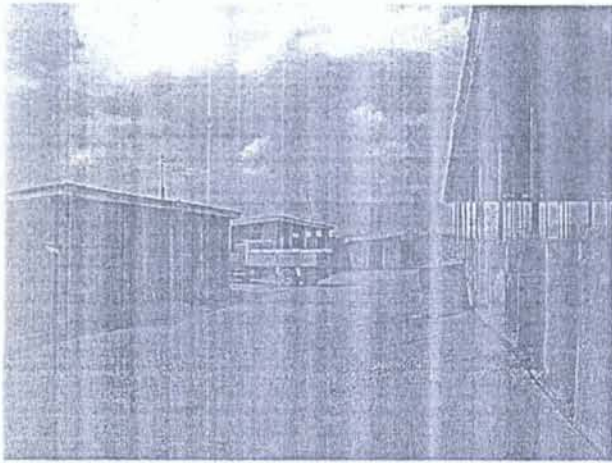


Fig. 4: A view of the Bodija Organo-mineral fertilizer Plant

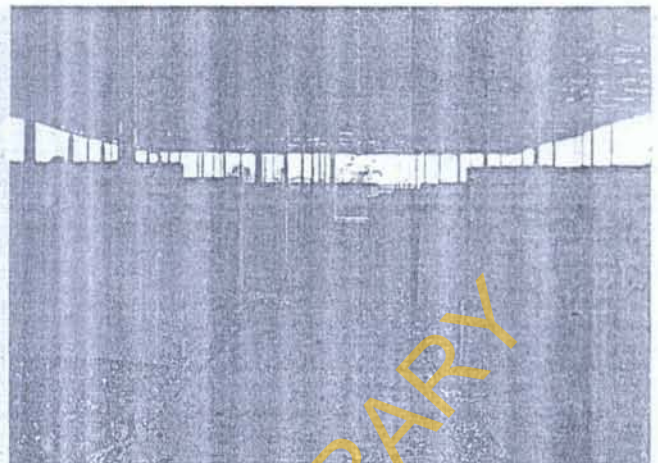


Fig. 5: A view of the composting windrows

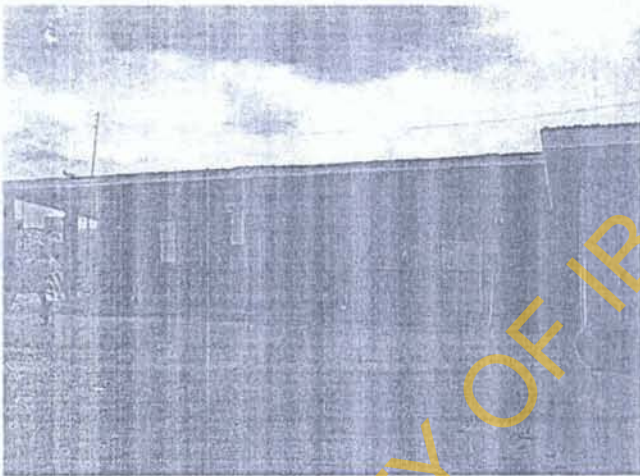


Fig. 6: A view of the machine shop showing the processing equipment

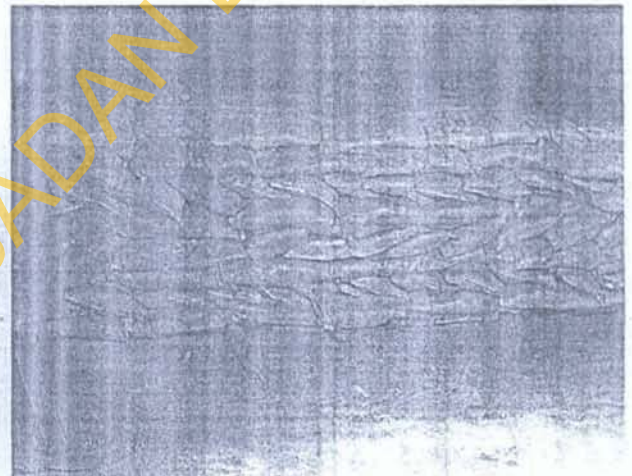


Fig. 7: Samples of 50 kg bagged organo-mineral fertilizer produced by the plant

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