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ملخص

استخدام اعشاب البحر كمكيف للتربة

ومصدر للطاقة

الغرض من هذه الدراسة هو تقييم تأثير الاحياء البيولوجية على تثبيت المواد العضوية بأعشاب البحر لامكانية استخدامها كمكيف للتربة ومصدر للطاقة . وقد استعمل لهذا الغرض ثلاثة احواض معملية بيولوجية . حوض هوائى تحت درجة حرارة المعمل (حوالى 20م) . وحوضين لاهوائيين تحت درجة حرارة 37م ..

لتقييم قدرة الاحياء البيولوجية على تثبيت المواد العضوية بأعشاب البحر . تم قياس الاكسجين الكيميائى الممتص وتركيز النيتروجين بكل من الاحواض الثلاثة وحجم الغاز الناتج عن التخمر اللاهوائى . كما تخلل فترة الدراسة التى استمرت مايقرب المائة وستون يوما قياس كل من تركيز ايون الايدروجين ، المواد العضوية والغير عضوية ، وايضا تدوين وملاحظة التغيرات فى كل من درجة الحوض الهوائى ، رائحة ولون الاعشاب وكذلك الاحياء البيولوجية فى التخمر اللاهوائى .

لقد وجد ان كمية الاكسجين الكيميائى الممتص ، المواد العضوية وتركيز النيتروجين فى تناقص مستمر مع الزمن وان حجم الغاز المجمع من التخمر اللاهوائى خلال فترة الدراسة 20 لتر لكل كجم اعشاب البحر . كما لوحظ ارتفاع فى درجة حرارة الحوض الهوائى وظهور رائحة للغاز الناتج من التخمر وكذلك تغير لون اعشاب البحر بالاحواض الثلاثة من بنى فاتح الى لون اسود فى اواخر فترة الدراسة .

SEAWEEDS POLLUTION A RESOURCE POTENTIAL

Gallal. A & Faris. B *

I Introduction:

The rising needs of the world's rapidly increasing population have been satisfied mostly through the utilization of the natural resources scattered over the earths land (dry) surface. As many of these resources have been exhausted, attention is being focused towards exploration and exploitation of the resources in the aquatic bodies which cover almost two-thirds of the earth's surface. These aquatic bodies, including oceans, seas, lakes, rivers and other wet lands; have unique environmental features, which if properly managed, will turn these water bodies into inexhaustible sources of food, raw materials,and energy (1).

Some types of sea weeds are already being used by few nations (Japan and South-east Asia) as a food source. Other types of sea weeds are being utilized for production of "Ajar-Ajar" (1). Also, sea weeds are being used in wood and paper manufacturing (2).

Sea weeds of the type "Posidonia oceanica", is an example of the many sea plants found in warm water coastal areas of the Mediterranean sea (including Libyan shores) and in other warm water areas such as California and Australian shores (1,3).

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This type of sea weeds (Figure 1) grow in shallow waters up to a depth of 2.0 meters. These weeds are continuously washed off by waves and currents onto the shores rendering them silty, polluted and unsuitable for swimming and industrial uses for most of the time of the year.

Utilization of sea weeds for production of soil conditioner (in the areas where fertilizers are in short supply) and/or in producing methane should reduce shore pollution and improve the environment. Also, the products can be used for more food and energy production.

The Libyan shore which extends about 2000 kilometres contains huge amounts of sea weeds. This preliminary study was undertaken to evaluate possible utilization of sea weeds as a soil conditioner and as a source of energy.

2. Purpose and Scope:

2.1 Purpose: The purpose of this paper is to evaluate the potential of utilizing sea weeds as an additive to domestic solid waste compost to increase its organic fraction and as a source of energy and organic matter.

2.2 Scope: In this study, a bench scale compost system, and a bench scale digester system were used. The experiments were carried out using shredded sea weeds for more than one hundred fifty days. The operations of the laboratory scale systems were assessed by

Posidonia oceanica: A, habitat x 0.5; B, sea ball x 0.5; C, bisexual flower x 3; D, stamen x 6; E, gynoecium x 6.

Figure 1. The type of sea-weed found on Libyan shores (3)

measuring the variation of pH, chemical oxygen demand (COD), volatile solids, electrical conductivity (EC) and gas volume from the anaerobic digesters. Observations of predominating microbial species in anaerobic systems, color changes and odor in the aerobic compost system were also made.

3. Experimental Apparatus and Operating Procedures:

3.1 Compost System: The experimental apparatus used in the bench scale compost system is shown in (Figure 2). The plastic reactor was filled with seaweeds to about two thirds of its depth. Seaweeds formed as a heap inside the reactor. The heap was aerated daily for a period of eighteen hours using a small compressor. Air was diffused through the heap through openings along a manifold. A drain was also provided in the reactor so that water produced as a result of moisture addition and composting can be disposed of readily.

The compost was inspected daily and mixed manually to ensure uniform environmental conditions throughout the composting material.

No attempt was made to control the temperature or humidity of the compost. Temperature of the compost was measured periodically. Moisture content and pH were also monitored regularly.

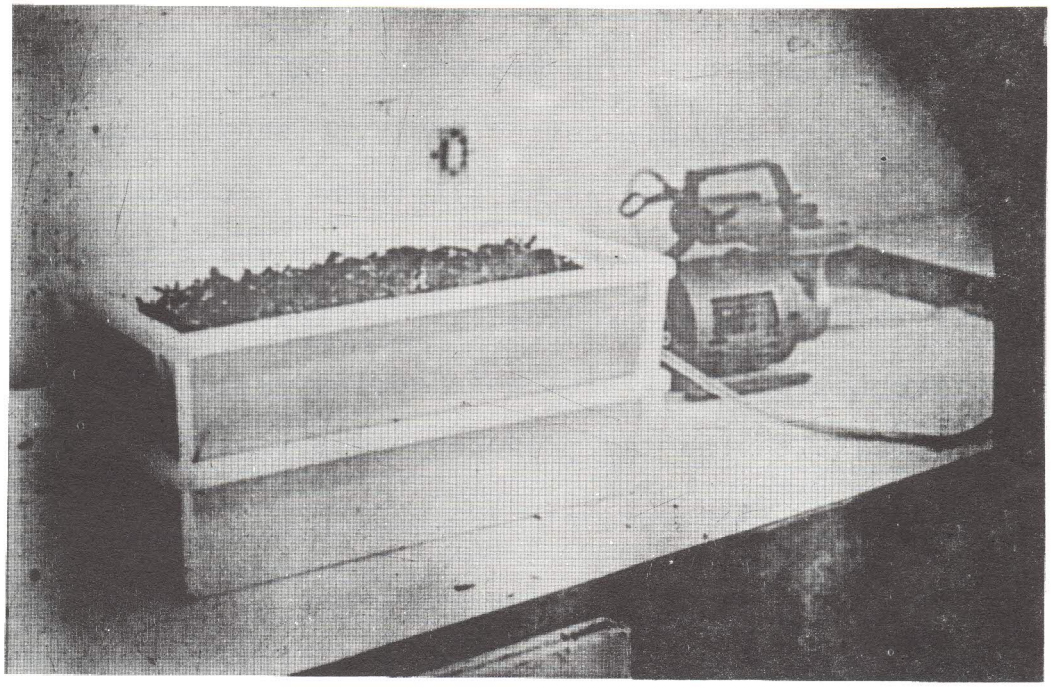

Figure 2. Bench Scale Compost System Showing; Sea Weeds Heap, Reactor & Air Compressor.

3.2 Anaerobic Digestion System: The experimental apparatus used in the bench-scale anaerobic digestion system is shown in (Figure 3). Three four-liter glass bottles (reactors) were seeded with cow dung.

The first reactor contained 100 milliliter (100 cm^3) seed diluted with tap water to four liters and thus used as control. The second and third reactors contained 100 and 200 ml. respectively, of seed along with 500 grams of sea weeds each. All three reactors were placed in a temperature controlled reactor which is maintained at 37°C. The gas produced was collected in one litre inverted beakers which were emptied as they became filled with the gas produced. The contents of the digesters were not mixed.

4. Discussion and Conclusions:

4.1 Sea weeds hold a promise as a resource with many potential beneficial uses.

4.2 Sea weeds are not as hard to decompose and biodegrade as paper in municipal solid waste, with carbon, nitrogen, phosphores (C:N:P) ratios of (45, 1.3, 0.03) compared with for paper (40, 0.03, 0.1). (4).

4.3 Sea weeds are anaerobically biodegradable with potential gas production of 0.02 m^3 of gas for each one kilogram of 10% moisture sea weeds.

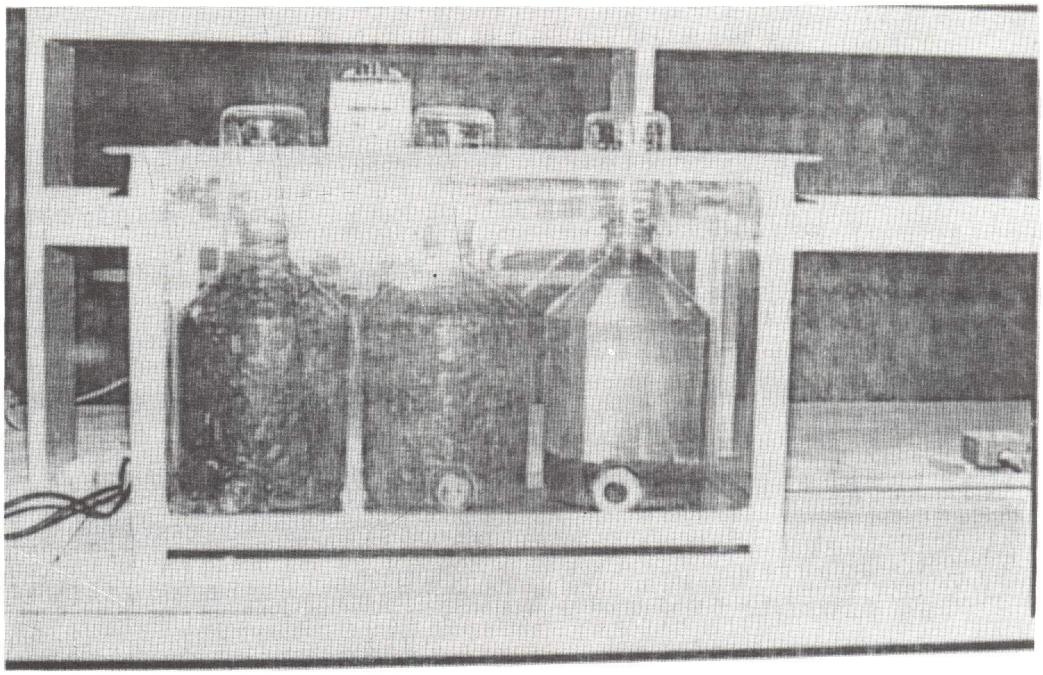

Figure 3. Bench scale anaerobic digestion system ; Showing, temperature control at the top, water filled tank; and from right to left in side the tank; control, 100 ml seeded, and 200 ml seeded digestor bottle.

4.4 Many nations specially around the Mediterranian sea have limited land for cultivation, most of it being sandy soil. Adding sea weeds compost will increase the value of solid waste compost, improve the soil condition and reduce the need for chemical fertilizers (5).

4.5 Energy can be extracted from anaerobic biological degradation of sea weeds with the stabilized material can be used as soil conditioner. Possible method of energy extract is by Pyrolysis and heat treatment which will produce more energy with no soil conditioner end product (7). Energy production can also be increased if a source of H_2 is provided for methane bacteria to convert all carbon dioxide to methane according to the equation:

$$CO_2 + H_2 \xrightarrow{\text{Bacteria}} CH_4 + H_2O \quad (6).$$

4.6 The potential for use of sea weeds in animal feed, cardboard, wood, paper, etc., should be investigated along with coordinated efforts to ensure useful research for all involved.

4.7 Sea weed characteristics: Results of the sea weed characterization study are summarized in Table 1. No attempt was made to determine the BOD of sea weed as very long period of incubation will be required before any biological degradation occurs. As the goal of the experiment was to determine the biodegradability and nutrient value of sea weeds, COD and nitrogen were determined. The high COD value and the high volatile fraction are

indications of the organic nature of sea weeds which are composed mostly of cellulose. The (C.N.P) of sea weeds was 45, 1.3, 0.03.(7).

4.8 Compost Study: Sea weed amenability to biodegradation was demonstrated in both the compost and anaerobic digestion studies.

Biodegradability of sea weeds as a result of composting was demonstrated by the noticeable increase in the compost temperature, the misty odor resulting from gas released as a by-product of composting, and by the reduction in the amount of organic (volatile) solids observed along the course of the compost study.

A summary of the compost study results is presented in Table 2. The decrease in COD value is also an indication of seaweed decomposition. The C:N ratio increased throughout the course of the experiment. The volatile solids (VS) fraction decreased.

Table 1 : Average Operational Data of Sea Weeds Study

Date	Sample Source	pH	COD mg/l	N %	Volatile Solids
4/2/87	Untreated	7.1	4760	0.1	60.5
24/3/87	Compost aerobic	-	4432	-	56.5
	Anaerobic digester I	6.8	3976	-	59.2
	Anaerobic digester II	6.7	3816	-	58.1
16/7/87	Compost	-	3960	0.095	53.9
	Anaerobic digester I	6.7	3716	0.06	46.4
	Anaerobic digester II	6.6	2960	0.09	45.7

Table 2: Sea-Weeds Gas Production (at 37°C no pH control)

Days from start	Accumulated Gas Production (ml) Control	Exp. 1 Container With 100 ml Seed	Exp. 2 Container With 200 ml Seed
0*			
11	200	800	1000
20	400	1450	1850
24	450	2250	2850
31	600	3100	3850
38	800	4100	4850
46	900	5100	5250
48**	1000	5750	6400
60	1200	6750	7200
76	1400	7620	8050
102	2000	8670	8950
159	2100	9120	9470

* At start, control was very active.

** A sample was taken for analysis and 200 grams of sea weeds were added.

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