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Biological treatment of waste and monitoring of parameters indicative of the hygienic quality of the fermentation product

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ABSTRACT

The biological processes are practices, which are better appreciated for the organic waste processing. According to the literature two types of waste are studied. The first category is comes from exploitation activity. (Agribusiness industry, and industrial agriculture's products). The second one coming from the activities of consumption: (household waste). We are interested in this work in the exploitation of household waste. We borrowed the biological way of treatment, particularly spontaneous fermentation. The physicochemical analyses in end of fermentation showed that the values of the pH are lowered to 3,86. Whereas the initial pH was of 4,46. The most interesting parameter in our study is acidity. The latter knew an increase of 4,2%. Following that, we found a disappearance of nematodes in late fermentation (3rd week). While during the first week, their number has grown to a population of 340 with the appearance of a slight odor. Also we noted the complete abolition of the biomass of the coliformes (fecal and total) sources of the more share of the epidemics. The staphylococcus was also exterminated. The abundance of the total flora mesophile aerobi (FMAT) was reduced to a level which cannot carry damage to the hygienic quality of the end product. After the 3rd week, the FMAT was represented only by one population of 6,2 10^5 ufc/g. As regards lactic yeast and bacteria, we observed a considerable growth of their populations. They were respectively at the end of the fermentation of 4,8 10^5 ufc/g and 5,2 10^5 ufc/g. The last two groups of germs are known by their biotechnological interest. Their presence in our case is comforting factor. They are for us the best indicator of the good orientation of fermentation. The presence of these two groups has enabled to us to better include/understand the practical incidences on the end product, as well as the general parameters of operating system. Fermentation leads us to a stable product and ready with a possible valorization. A test of improvement of the general parameters of fermentation was examined. It is about the incorporation of the molasses in the raw material. Four mixtures were prepared. The best result is obtained with the incorporation of 9% of ferment. The latter resulted to a product of which physico-chemical and hygienic characteristics correct.

KEYWORDS

Organic waste;
Processing, ferment;
Biological processes;
Valorization;
Microorganisms;
Nematodes;
Coliforms;
FMAT;
Staphylococci;
Streptococci;
Hygiene.

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INTRODUCTION

Morocco along with other under developed countries are consumption societies. The consumption level is constantly increasing year after year ever since the development of the industrial tissue and the easiness of trade exchange. A second factor improves the situation; in fact it is the demographic development and the improve ness of health systems and medication.

All together, these factors have led towards a huge and varied consumption.

This plight is not limited exclusively to Morocco, rather it can be located throughout the globe, involving thus an abnormal wastes' production.

Indeed, Wastes' are increasing is a significant way both in quantitative and qualitative terms and patterns involving huge environmental risks and consequently public health hazards.

This plight is much more preoccupying in the developing countries which are facing major difficulties related to the lack and scarcity of relevant means and how to tack le the issue with an adapted approach to their specific contexte.

Besides, there is a significant lack of specific data related to wastes' characterization which is the upstream of management strategy. There is also the fact related to the difficulty to update the data because of mainly the excessively expansive costs of used methodologies, thus a barrier to implement an efficient and lasting policy for the wastes' management in the developing countries.

The 21th century's challenge for developing countries lies within the wastes' management and the full compliance with earth's rights and law for a reminder, the new integrated wastes' management has been adopted by the United Nations during Rio's world conference for environment and sustainable development in June 1992.

As a matter of fact wastes' management has to be framed within a global sustainable development's strategy with basic principles focusing mainly and underlining a viable environment (environment's degradation costs), the sustenance of a natural capital and asset (eco compatible and biodiversity).

At this level and in the perspective to decrease the negative impact of wastes' in the municipal dump of Kenitra city in Morocco, our Laboratory has subscribed in the policy of sectorial fragmentation of the organic wastes which are received in the municipal dump.

Biological fermentation constituted the axis N°2 of our policy so as to minimize the pollution problem threatening the city of Kenitra.

To Under take the tasks assigned to us, we are leading an evaluation and assessment of a first section of wastes coming to the municipal dump. We are then dealing with domestic and House's wastes.

The raw material will be submitted after wards to A natural fermentation process with quantitative incorporations different from a specific carbon source. The fermentation cycles are multiple and will indeed make it possible for us to take relevant decisions with regards to possible applications.

MATÉRIEL AND METHODS

Readiness of study outfit

Organic wastes are collected from Kenitra city Housing blocs bins. Later they are sorted ad then are grinded through a mechanical grinder what comes out from this process is dispatched : 5kg in 5 pots of each a capacity of 10KG each pot is then added with an appropriate ferment percentage (5%,6% 7% 8% 9% 10%).

2.1 Physicochimical Analysis

2.1.1 Determination of Acidity

10ml of the liquid phase, of the analysis sample are decanted in béchers of 100ml

Some drops of the colored indicator (Phynophtaleine to 1%) are added to this mixture.

The titrage is realized through a NAOH (N/9) solution till the colored indicator becomes pink of color. The acidity is expressed in lactical acid percentage (PM=90,08) by 100ml of culture given by the following formula acidity (%) □ $VolNaOH \times N\,NaOH \times 90{,}08 \times 100$

1000 x *Masse échantillon*

2.1.2 pH Determination

The pH is measured with the help of a phmeter of Orien Research Brand the measures values are levied after étalonnage of the apparatus. The etalons used are ph 4 and 7.

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2.1.3 Humidity Détermination

Humidity is determined by 5g passage of the sample to analyze through a sweating room during 6 Hrs and at 105C°. The weigh difference between the pre and post drying gave us the calculus tool of the humidity value the equations expression is the following:

$$\text{Humidity} = (m2 - T)/(m1 - T) \times 100$$

With M1 = Trial talking (g), M2= Mass after steaming (g), T = Box Mass (g)

2.1.4 Dry Material determination (MS)

The dry material is determined with a fraction of a five grams sample submitted to a 105°c temperature till the weigh stabilization.

The 5g mass is put in a crucible which was already dried and tared (To) in the same condition before hand. The crucible is after that put in a dessicator until cooling.

The mass (M2) corresponds to the cooled sample with its crucible. The expression of the dry materiel is given by the following equation: % MS = [(M2-T)/ M1]*100

2.3 Microbiological analysis

Microbilogical analysis focalized mainly on flora of hygienic interest and flora of biotech logical interest.

2.3.1 Dilution préparation

10g of each sample are levied and added to 90ml of a sterilized physiological water the set is put within an Erlenmeyer of a 250 ml capacity.

Thus we obtain a 10-1 dilution. The remaining dilution (10-1 to 10-7) are successively realized by adding 0, 5 ml of the solution to dilute in 4, 5 ml of sterilized physiological water

2.3.2 The seeding

The seedings are undertaken in a solid culture milieu. 0,1ml of the adéquate dilution is deposited in a kneading box. 20ml of the prealably sterilized gelosed milieu to 120°C are then aseptically poured after cooling to a temperature of 45°. The box is after that homogenized and incubated in a steaming tool with a convenient temperature.

It depends of the nature of the studied microorganism.

Each seeding is performed in three copies. Only the boxes which the colonies is comprised between 30 and 300 are selected for counting.

2.3.3 Determination of the plurality of Fecal and Total coliforms

Are germs accustomed to the human or animal digestive tube. Are also considered as indicators of the hygienic quality of the analyzed product. The culture environment used is DCL (desoxycholate lactose agar).

The counting is realized after a 48H incubation period to a 37°c (temperature for total coliforms and 44, 5°c for fecal coliforms)

Determination of the multiplicity od staphy lococs and streptococs.

The presence of these germs in an aliment is witness of a lack of health.

The selective milieu used for staphylococs is the Chapman. the one used for streptococcus is KF streptococcus. The two groups incubation is conducted with a 37°c Temperature. The reading is done after 48H.

2.1.4 Yeast Mass determination

These germs are known for their bacteriological use fullness. Their masse evaluation in a biotope is conducted through a culture in a PDA environment after a 48h period incubation to a 30°c temperature.

2.1.5 Lactical Bacteria Mass Determination

These are the same germs of biotechnological use the most known setting for their counting is the MRS. The colonies corresponding to this group can be counted after an incubation time of 24H to a 37°c temperature.

RESULTS OUTCOMES AND DISCUSSION

3.1 Aliments physicochemical analysis

3.1.1 pH

The pH is a significant parameter so as to conduct the good validation and the straight forward fermentation orientation. We have achieved a pH follow up over all the fermentation period the results obtained are mentioned in the chart (1). This latter shows that the waste's fermentation constituted the origin for the pH values change what so ever the processing nature that is combined to the pH. Hence for a 5% ferment concentration the pH has shown a significant decreasing after a 3 weeks fermentation period. The pH ditched from 4, 46 to 3,8.

For the pot which contains 6% ferment, the pH started from the first day with a 4,44 value to slide down to a 3,66 value by the fermentation closure.

To 7% ferment, the mixture started by a 4,51 pH but the variation were limited . It has reached and stopped to 3,97 value.

The 8% ferment pot has augmented to a 3,64 towards the end of the fermentation . But it has started with a 4,36 value . To a 9% ferment value, the pH submits a considerable reduction to reach 3,60 against a 4,46 starting value.

As to 10% ferment, the pH hasn't seen a significant change it has begun with a 4,33 value to come down to a 3,93 value by the end of fermentation .

What so ever is the percentage of the added ferment the result is a pH decrease. The reduction was 15% for a 5% ferment inclusion. 18% of reduction for a 6% inclusion. 12% reduction for a 7% inclusion. For a 8% integration the decrease of pH reached 17% . The most important reduction was observed for the 9% inclusion which is 19% value. The last integration produced a slight 8,5% reduction, thus by basing oneself on the reduction percentage and the low level obtained from the final pH, the integration of 9% ferment is the best appropriate for an eventual controlled fermentation.

The pH decreasing observed for the pot with 9% ferment is probably resulting to the populations dynamics, populations composing the core of the fermentation, this can also be related to the organic acids released by the bacteria existing in the mixture.

3.1.2 Acidity

The acidity is no less important with regard to pH . The follow up of this parameter is led like precedently. The chart 2 shows the acidity evolution during time. The fermentation is achieved within pots of 10kg each through an ambient temperature.

The 5% pot has registered an increase of 9,5% of acidity after 3 weeks fermentation duration. Therefore, this fact allows the deduction that no matter the ferment inclusion is weak, we can notice a certain dynamic occurring in the wastes' Mass for the 6% of ferment, we have observed an acidity augmentation of nearly 24%. This one moves from 2,9% to 3,6% after 3 weeks of fermentation.

The inclusion of 7% of ferment favorised an acidity boast of 33%.

When it comes to the sample of 8% of ferment the increase was 37%, which makes it evident the proportionality of inclusion and the result obtained.

Chart 1 : Change of the pH in the witness and those with different ferment inclusions. Fermentation conducted in Futs with kgs and within an ambient temperature.

Time of incubation / Tests	T0	T1	T2	T3
5% of ferment	4,6	4,32	4,32	3,8
6% of ferment	4,44	4,03	4,03	3,66
7% of ferment	4,51	4,05	3,97	3,7
8% of ferment	4,36	4,14	3,97	3,64
9% of ferment	4,46	3,76	3,86	3,62
10% of ferment	4,33	3,96	3,93	3,7

NB: - T0: First week of fermentation
-T1 Second week of fermentation
- T2 Third week of fermentation
- T3 Forth week of fermentation

For 9% of ferment, the acidity has known a clear increase by comparison to what has preceded and even the following. The increase is almost 60%. This has started by 2,63 to reach 4,2 in the end of fermentation. An interesting augmentation and pushes toward choosing this inclusion for the controlled fermentation tests.

What was noticed for the 10% inclusion is the acidity

Chart2 Variation of acidity in the witness and those with different inclusions of ferment. Fermentation achieved within 10kg pots each and at an ambient temperature.

Time of incubat / Tests	T0	T2	T3	T4
5% of ferment	3,15	3,3	3,45	3,75
6% of ferment	2,91	3,3	3,6	4,05
7% of ferment	2,85	3,65	3,8	4
8% of ferment	2,55	2,7	3,50	2,1
9% of ferment	2,63	3,75	4,2	4,11
10% of ferment	2,4	2,93	2,9	2,25

increase of 20%.

The acidity increase is an expected result for this kind of blending. The results obtained confirm the expectation with exception of 10% ferment proportions the acidity change was worrying and preoccupying. This is probably related to ferment concentration effect this result allowed us to choose the 9/9 combinaison ferment domestic wastes.

The increase of the acidity noticeable in the ..... with 9% of ferment is probably caused by the dynamic of population composing the core of the fermentation and organic acids released by bacteria present in the mixture.

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3.1.3 Humidity

The follow up of humidity values evolution is represented in chart 3 Figures. We were focusing in these parameters evolution because it is temperature in the success of the process related to controlled fermentation of our vegetal Material.

The reading of the obtained values allowed us to conclude that there is generally a humidity increase. This assumption is declared for all tests 5%,6% 7% 8% 9% 10%) only for the last one (20%) in which a drop down of 17% of Humidity has been recorded .

The released amount of water resulting of metabolic processes has either been attached in other chemical reaction or either released by chemical or physical mechanisms that are unknown or solar.

The approach we have chosen was completely different from the one used by[5]. The last ones have obtained an 11% humidity they have proffered the incineration option to process domestic wastes the processing s have been achieved both in Nouakchoute in Mauritania

3.1.4 The dry Material

The evolution of the dry material in terms of different ferment concentration is recorded in the chart number 4. At this level we have noticed an abnormal behavior. We have forecasted the drop down of all the tests groups. However, in 60% of the achieved tests, we have en countered the opposite of what is expected (5% and 6%). The other tests were normal's. The collapse of the dry material has reached 28% against 33,04% for the 5% ferment sample.

Chart 3 : Humidity variation in the witness and those with different inclusions of ferment . Fermentation realized in 10kg pots and at an ambient temperature.

Time Of incub / Test	T0	T1	T2	T3
5% of ferment	41,3	34,33	42	36,67
6% of ferment	41,33	42,67	43	42
7% of ferment	42	42,87	44,54	48,43
8% of ferment	42,67	45	43,33	45
9% of ferment	40	43,67	44,67	49,67
10%of ferment	44,33	33,33	36,67	36,67

This represents a weight drop down of 15% as to the 20% test, he weight loss has recorded for the dry material 29,34% against 35% this means 17% of reduction.

For the two weights loss observed, the feature is the same. We are neare of initial weight loss.

The found results from these tests match perfectly those recorded by[2], when they have worked on the same kind of wastes. The increasing observed can probably be explained by evaporation in water. The fermentation cuve was exposed to ambient air. The ratio weight sec/weight humid is 0,8[5] found a 0,78 report.

3.2 Microbiological Analysis

The domestic wastes are put under spontaneous fermentation. We were interested in the follow up of the population dynamic the population targeted by this study are: FMAT, Total and Fecal Colforms and Lactical Flora and yeasts.

3.2.1 FMAT counting

Chart 4 : Variation of the dry Material in the witness and those with different ferment inclusion. Fermentation realized in 10kg each pots and at an ambient temperature.

Time of incub / Essais	T0	T1	T2	T3
5% du ferment	33,04	27,46	28,00	29,34
6% du ferment	33,06	34,14	32,8	33,6
7% du ferment	33,43	34,76	35,87	39,23
8% du ferment	34,14	36,00	34,66	36,00
9% du ferment	32,00	34,94	35,74	39,74
10% du ferment	35,46	26,66	29,34	29,34

Chart 5 shows FMAT evolution during a time process. Results displayed show that mesophile flora total is variant. It is at its minimal level of 6,2 105 ufc/g for sample of 9% ferment. But it becomes to 2,4 106 ufc/g for 5% ferment sample.

After three weeks' time fermentation, Microbian abundances have shown no important differences. In all the tests, we have observed a diminution with regards to the initial abundance. But the last one has no exceeded a logarithmic unit.

Such abundance can be acceptable if the pathogenous group is not present in it otherwise, the hygienic quality can be compromised.

The observed diminution is expressed by pH diminution and the increase of acidity which are not tolerated by some bacterial groups. On the other hand we hope to notice the multiplicity of yeasts and lactical bac-

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teria of which the existence is synonymous of the good steering of the fermentation.

The quantity reduction of the FMAT can also be explained by the existence of bactericidal substances which are generated by the lactical bacteries.

Despite being high we remain bellow abundance values of the FMAT found by the researchers team[1] this group has worked on urban wastes composting the value reached is 1,4 106 ufc/g.

3.2.2 Fecal and Total Coliforms counting

Chart 5 Shows the evolution of fecal coliforms' population through time. We can deduct that the indigenous population dynamic has eradicated fecal and total coliforms.

A single week was enough to achieve the extermination of a whole indicating population containing fecal contamination.

Chart5 : Abundance of evolution of FMAT according to chronological period. Tests done with different ferment concentration and at an ambient Temperature.

Time of incubat / Essais	T0	T1	T2	T3
5% du ferment	$2{,}00\ 10^4$	$2{,}20\ 10^6$	$2{,}40\ 10^6$	$1{,}40\ 10^6$
6% du ferment	$8{,}00\ 10^4$	$1{,}26\ 10^6$	$1{,}44\ 10^6$	$1{,}06\ 10^6$
7% du ferment	$4{,}80\ 10^5$	$1{,}16\ 10^6$	$1{,}60\ 10^6$	$1{,}52\ 10^6$
8% du ferment	$8{,}00\ 10^4$	$2{,}20\ 10^6$	$8{,}00\ 10^5$	$6{,}80\ 10^5$
9% du ferment	$1{,}00\ 10^5$	$2{,}06\ 10^6$	$6{,}20\ 10^5$	$5{,}80\ 10^5$
10% du ferment	$1{,}60\ 10^5$	$4{,}60\ 10^5$	$1{,}30\ 10^6$	$8{,}80\ 10^5$

The initial fecal coliforms population was 1,86 106 ufc/g . Population of total coliforms was 2 103 ufc/g . For us this is an indicator related to the finished product.

Such a result is very revealing to have in mind how to prepare an alimentary formula.

We have after that to confirm the nutritional qualiy.

T he results obtained by[1] have proven that total and fecal coliforms population has diminished by the thirtieth composting day. After wards, it is eliminated after a five month fermentation period.

In both the experiments, it seems that the used fermentation allows a gain of time it is even possible to process more weight of tows in a small amount of time and thus contribute to the reduction of the entrants impact (solid wastes) in the landscape.

3.2.3 Staphylococcus counting

Chart7 Illustrates the evolution of the multiplicity of staphylococcus through time. The tests were conducted at different ferment concentration and at ambient temperature. The results generated demonstrate that pathogenous flora that was studies is very weak within the raw material. It is eliminated within the first fermentation week.

Chart 6 : Evolution of total and fecal coliforms through time tests undertaken at different ferment concentration and at an ambient temperature.

Time of incubat / Tests	CT/CF	T0	T1	T2	T3
5% of ferment	CT	$5{,}20\ 10^2$	0	0	0
	CF	$1{,}56\ 10^3$	0	0	0
6% of ferment	CT	$2{,}80\ 10^2$	0	0	0
	CF	$1{,}44\ 10^3$	0	0	0
7% of ferment	CT	$4{,}00\ 10^2$	0	0	0
	CF	$1{,}08\ 10^3$	0	0	0
8% of ferment	CT	$8{,}80\ 10^2$	0	0	0
	CF	$1{,}60\ 10^3$	0	0	0
9% of ferment	CT	$2\ 10^3$	0	0	0
	CF	$1{,}86\ 10^3$	0	0	0
10% du ferment	CT	$4{,}80\ 10^2$	0	0	0
	CF	$8{,}80\ 10^2$	0	0	0

The decrease or the diminution of this flora is probably related to destroying factors developed in the fermentation content (pH, Acidity, Bactericidal substance, anabolic inhibitors, catabolic inhibitor…)

The random elimination of our samples staphylococcus is an indicator of the proliferation of an acidifying flora and with a positive technological feature it is also indicating an Improvement of the products hygienic quality.

Three lactical bacteries have eradicated within twelve days the whole staphylococcus flora present in the slaughter houses 'Wastes[7].

This is for us a fact that can lead to explain the case for staphylococcus obtained in our case.

3.2.4 Streptococcus counting

The result issued from streptococcus counting is displayed in chart N° 8. The tests were led at different ferment concentrations and different temperature.

We notice that streptococcus are absent since the fermentation's beginning the key factors behind this fact are likely the same than those mentioned beforehand.

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The four hazardous groups afore mentioned and

Chart 7 : Evolution of staphylococcus in time. Tests achieved at different concentration of ferment and at an ambient temperature.

Time of incubat / Test	T0	T1	T2	T3
5% of ferment	5,20 10^1	0	0	0
6% of ferment	3,20 10^1	0	0	0
7% of ferment	4,80 10^1	0	0	0
8% of ferment	3,60 10^1	0	0	0
9% du ferment	4,40 10^1	0	0	0
10% du ferment	3,60 10^1	0	0	0

declared pathogenous are completely eliminated from the fermentation's product. For us this is an indicating symbol for the good path of the fermentation and the preparation of a high correctly valuable hygienic prepared product.

The pH decrease of Alg wastes to 3,9 after fifteen fermentation days against 7,1 initial, was the starting element responsible for streptococcus elimination. Such are the outcomes of research's led by [4]. According to the same reference, there was elimination from the tenth day (10 th) of coliforms this teams obtained fermentation has been accompanied by an increase of organic material and organic carbon.

3 .2.5 Yeast Counting

The results issued from yeasts counting are mentioned in the chart N° 9, The tests are conducted to different ferment concentrations and at an ambient temperature. Like previously indicated, Yeasts are useful biotechnologically yeasts are found with a large quantity in comparison with other family origins. This can be explained by their mixture when ferment is added.

Chart 8 : Evolution of streptococcus in time. Tests achieved at different concentration of ferment and at an ambient temperature.

Time of Incub / Test	T0	T1	T2	T3
5% du ferment	0	0	0	0
6% du ferment	0	0	0	0
7% du ferment	0	0	0	0
8% du ferment	0	0	0	0
9% du ferment	0	0	0	0
10% du ferment	0	0	0	0

Another key element enhances this hypothesis; it is the increasing of their initial number which goes hand in hand with the percentage which increasing of ferment mixture.

The augmentation of yeasts population in the fermentation is very interesting. This Microorganism set is known with its positive impacts on nutrition level, buffer,Bandage,Mediator for meteriosation problem of ruminants, best chrome provider…..

The whole set of these remarks make it possible to broaden horizons toward a better mastering of work conditions to let them shift from simple experimentations within the laboratory toward large scale applications[2, 3]. by working simultaneously on Olive and wastes domestic type have demonstrated that yeasts have played an interesting role in the improvement of the organoleptic quality of each on of the two products.

3.2.6 Lactical bacteries counting

Chart N° 10 shows the evolution of lactical bacteries abundance through fermentation time the tests are realised at different ferment concentration and at an ambient temperature lactical bacteries are also know by their biotechnological interest they are used in several patterns to transform agro-alimentary product.

The figure number of lactical bacteries present by product set of fermentation is found in 5 logarithmic

Chart N°9 : Evolution of yeasts abundance in terms of time Tests conducted at different ferment concentration and at ambient temperature.

Time of Incub / Test	T0	T1	T2	T3
5% du ferment	2,00 10^4	1,20 10^4	3,40 10^5	3,56 105
6% du ferment	3,40 10^4	1,00 10^5	4,40 10^5	3,95 105
7% du ferment	9,00 10^4	2,40 10^5	4,80 10^5	5,20 105
8% du ferment	1,20 10^5	6,08 10^5	7,60 10^5	6,45 105
9% du ferment	2,50 10^5	6,68 10^5	8,80 10^5	8,10 10^5
10% du ferment	3,52 10^5	5,60 10^5	5,60 10^5	5,40 10^5

units. A second indicator of the best position of our approach regarding biological transformation the lactical bacteries will mostly enhance the hygienic quality along with organoleptic features of the finished product.

On one hand the lactical bacteries and on the other hand the yeast they are all tools assuring the path taken a second confirmative key element is the one regarding the complete wipe out of pathogenous elements.

The hygienic and food quality sought by food industries operators are found in our product. What remains is the smoothing of nutritional benefits to respond to the specific needs of the animal in question the lactical bacteries used by [6] .

In 2003 for avian and poultry droppings fermentation they were the origin of the pathogenous elements reduction at levels not exceeding elements reduction at levels not exceeding 10 ufc/g the lactical bacteries responsible of this result are lacto bacillus plantar us and pedioceccus acidilacticici.

CONCLUSION

The general principal of the biological treatment is to exploit some microbial activities by stimulating them in a controlled manner to reduce potential hazards related to wastes (odours. Health hazards, Polluting aspect at literal sense) or to valorise agro alimentary product and to give them a valve added.

The biological process used in our case has a purplose which is the wastes processing in the kitchen such wastes that are known by their biodegradable. It is completely different from other process making use of thermical or physico-chemical techniques.

Chart N° 10 : Evolution of lactical bacteries abundance through time process tests done at different concentration of ferment and at an ambient temperature.

Time of Incub / Test	T0	T1	T2	T3
5% du ferment	$3{,}00\ 10^4$	$2{,}40\ 10^5$	$4{,}60\ 10^5$	$7{,}20\ 10^5$
6% du ferment	$8{,}00\ 10^3$	$4{,}24\ 10^5$	$6{,}80\ 10^5$	$8{,}40\ 10^5$
7% du ferment	$3{,}60\ 10^4$	$2{,}20\ 10^5$	$4{,}00\ 10^5$	$6{,}00\ 10^5$
8% du ferment	$2{,}52\ 10^5$	$2{,}80\ 10^5$	$3{,}60\ 10^5$	$2{,}90\ 10^5$
9% du ferment	$8{,}40\ 10^4$	$3{,}00\ 10^5$	$5{,}20\ 10^5$	$5{,}60\ 10^5$
10% du ferment	$2{,}00\ 10^5$	$4{,}20\ 10^5$	$6{,}00\ 10^5$	$7{,}20\ 10^5$

We have analysed the raw material (Maroccan kitchen wastes) Blended to different ferment concentrations. The results obtained compared to those obtained after fermentation during three weeks show a significant difference.

For physicochemical parameters, the dry material has dropped from 15 to 17% simultaneously for the two tests of fermentation (5% and 10%). In a general way the alimentary formulation of the finished product will necessitate a good reflexion at the time of mixture so as to produce an economically correct product.

The pH was for us an element assuring the hygienic quality of the fermentation product.

Each one the studied Micro organisms allowed us to draw an information with regards to hygienic and nutritional quality of the fermentation product. The FMAT abundance is important.

It has remained constant during almost all the fermentation period. Soch and abundance is probably composed of lactical bacteries and yeasts . The results of the abundance of the two groups confirm this fact. These two groups alone can make changes of the hygienic and nutritional quality of the fermentation product.

The process of biological processing of the kitchens wastes is according to us a strong and well approved for its resultants it does not demand sophisticated technologies and is relatively cheap to implement.

However, a certain know-how is necessary for an efficient and lasting implementation especially the good adequation between the technical materials used the operational conditions, the waste(s) processed, the socio-economic context and techniques and the objectives of the processing.

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