DYNAMIC CHEMICAL PROCESSES UNDERLYING BD HORN MANURE (500) PREPARATION

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Introduction

Chemists and laboratories are excellent at producing quantitative data about compounds. Taken alone, information about compounds are like numbers and are static, or dead. Yet, behind normal chemistry is another chemistry— that which reveals life processes. Macksensen speaks of substances or compounds as "..the residues or signposts of processes" (Mackensen, 1997). We do not see processes, rather we see parts. The challenge is to handle the information- the parts- in such a way as to be guided to the movement or process out of which they arise. It is purely the mistake of modern object oriented perception to think that numbers and chemical compounds are things standing for themselves.

It has been one of the objectives of this laboratory to use routine laboratory tests, and some picture-forming methods, to gain a sense of the dynamic processes occurring in composting and in biodyanmic preparations during production and storage. In some of our studies we attempt to demonstrate that simple chemical tests such as pH, nitrate and carbon-dioxide activity can be applied to reveal aspects of the dynamic fermentation process and thereby support interpretation of quality consistent with visual, olfactory and other aesthetic evaluations (Brinton, 1983, 1986). In this report we summarize these and other investigations in which dynamic qualities are partially revealed by simple chemical analyses. Underlying this is an attempt to offer a practical, phenomenologically oriented chemistry.

There is an important principle evident in this undertaking. Can we show a relationship between analytical data and quality consistent with a view of formative forces? Let us re-phrase the question as a statement: life processes are whole-processes. Wholeness refers to process or movement and comprises the living. There is nothing that is not living that is not whole in this sense. Static representation of wholeness through chemistry and mathematics is not more than it seems: extracted and non-moving (Bortoft, 1996). Nowhere is the mistaking of parts for wholeness in chemistry more evident than in modern genetic biochemistry. Here, the massive illusion is being created that defines individual genes as controlling individual functions. Actually, the more we learn about genes the less we seem to know. In reality the interrelationships and connectedness of genes is awesomely convoluted (Holdrege, 1996).

When we reduce and analyze something in the laboratory, we take a snapshot, and thereby freeze the process that gave rise to it. But like any picture, it is understood that behind the compound tested is movement. The question becomes, how can we see the relationship between the static representation on the one hand and the original wholeness of the process on the other. Many say we can not, and this is based on the assumption that the aesthetic whole person can not bridge from perception- which by nature is static- back to wholeness. But by re-visiting chemistry with a view to the movement hidden behind the actual compounds measured, another picture can arise (Mackensen, 1997; Julius, 1988). BD Preparation 500 is an interesting case, owing to the remarkable transformation observed when manure is specially prepared in the manner Steiner originally indicated.

Early Studies on Biodynamic Preparations and Picture-Forming Methods

A fairly complete picture on the history of practice and research with some Biodynamic preparations has been presented by the Bolk Institute (Bolk) and also by Goldstein (1979). In our own studies, early laboratory work with BD preparation 507 left little doubt as to how quality could be judged using a variety of methods (Brinton, 1983). The best valerian preparations were found in conjunction with high solids content, low pH and a pleasant silage-like aroma. Yet, early results for preparation 500 presented a more complex or anomalous picture, for which new questions arose.

Some the earlier research associated with Biodynamics has been directed towards qualitative testing using “picture-forming” methods. These include sensitive crystallization, circular chromatography, and “Steigbilder” or capillary-dynamolysis (Engqvist, Kolisko, Pfeiffer, Steffen). Recent work continues to indicate that these picture-type methods do reveal interesting differences not normally seen by standard chemical methods (Nissli). But picture forming methods may create the impression— itself an illusion— that the picture itself is what we are looking for. It is not. The result is not unlike other “data” and is representative of a process. The basis of picture forming methods introduced by Steiner, Pfeiffer and others was twofold: to develop methods sensitive to living-formative processes and to invoke the imaginative (movement oriented) traits in the observer of the experiment.

Experimental Design

Biodynamic preparation 500 is made by with fresh, pasture-fed cow manure (or other manure) which is put into a cow’s horn and buried in the soil for the winter (Steiner, 1924). Results of the prior testing of 500 revealed that significant internal changes do take place in the manure during overwintering in the soil. The principal changes are a significant drop in pH, an increase in aerobic status and production of nitrate.Another aspect is that there is in many cases little evident loss of organic matter. We have pointed to the unusual nature of the findings, based on our experience in analyzing manures and composts.

It has always been observed by practitioners that the manure changes in this process, but previously little if any data on the composition was gathered. In our projects, manure used for 500 was tested at the outset, and then again at the completion. Since location effects were expected to occur, the same manure was used in different sites for one project. Variability was expected in relation to horns used. Therefore, we examined the quality of 500 from a range of differently sized horns treated in an identical fashion.

Analytical techniques we have used are described in an earlier report (Brinton) and are essentially the same as those routinely used by soil or compost labs. We characterize the horns by taking the ratio of total weight to volume (grams/ cc). Thus, large thin-walled horns have low ratios, approaching 1.0, while mature-horns approach a ratio of 5, i.e., they contain a great deal of substance in relation to actual volume. The ratio is calculated by weighing the horn, and then filling with water and measuring the volume. Loss of organic matter and nitrogen is calculated by contrasting initial and final values in relation to weight loss.

Results

Prep 500 made in artificial horns (glass jars of similar density/volume of cow horns) was compared to a group of varying horns ranging from small to large, the large comprising "poor horns" which were found to be questionable, and possibly from bulls. All horns were individually identified and buried side by side horizontally in the B-horizon layer which was enriched with some aged compost and topsoil. The samples were unearthed and tested in late May after a winter of moderate snow-fall and limited deep frost action. These samples were analyzed after brief storage in a root cellar.

Table 1: Varying Horn influence on Preparation Chemistry

Item	Horng /cc	Moist-ure	pH	Org-Matt	Total-N %	NH3 %	NO3 %	ORP mV	C:N	CO2-C
A-Raw Manure	-	84.3	7.80	85.85	3.133	2.056	0.343	-77	15.9	3.77
B-Poor-horns	1.40	83.63	7.98	78.11	1.890	0.180	0.010	-122	24.1	1.25
C-Artifical horns (glass)	-	83.30	7.80	77.19	1.830	0.240	0.010	-120	24.3	1.29
D-Good horn	3.40	72.98	5.61	80.59	3.602	0.723	0.648	239	13.2	0.64

Analyses conducted on the contents of each horn/container (4-8 in each group) were averaged by group and compared to the initial manure (A). We reported the horn weight to volume ratio (g/ cc). Considerable variation was seen in the samples. The higher density horns (D) produced well ripened material, having a pleasant humus odor and loose texture. These horns gave prep 500 with low pH's, low CO2-respiration and high total-N, nitrate and oxidation. These are extraordinary changes in chemistry fro the initial manure (A), also considering it has been buried so long.

We observed that there was very little difference between manure kept in artificial vessels (C), and that of the poor (B) horns, whereas (D) horn samples differ markedly. The artificial vessels gave the most anaerobic (lowest ORP) values upon being unearthed. The group (D) horn manure showed strongly aerobic values, in contrast. The artificial and poor quality horns are associated with little or no change in the manure over the winter, while the good group can not be recognized in relation to the initial lab analysis.

There were big differences in the amount of organic matter and nitrogen retained. On average, the good quality Prep 500 has retained more C and N, for example, it has kept 84% of initial nitrogen but the artificial/poor horn group (B-C) only 38%. Thus, in conjunction with a poor outcome of the ripening process, we find relatively large losses of organic and nitrogenous substance— a kind of "uncontrolled" decomposition. This early data indicated large internal chemistry changes in preparing Horn Manure preparation and confirmed that the type of container and quality of the horn plays n important role in the preparation process. Correlations show that as the horn weight to volume aspect increases, so does the apparent ripening of the material. For example, we find the lowest pH, best appearance and highest nitrogen retention in the group of heavy horns, and a low CO_2-respiration rate. Julius speaks of the "aggressiveness" of CO_2 and how with its" calming down", an "openness to living influences" is possible (Julius, 1998).

We also investigated results of making a similar preparation using horse manure, along lines indicated by Steiner, with the chemical results seen in table 2.

Table 2: Chemical Traits of Horse Manure before and after BD Processing

SAMPLE	Moist	pH	OM	TKN	NH3	NO3	ORP	C:N	C02-c
Fresh Horse Manure	76.0	6.30	85.73	2.324	0.031	0.012	-34	21.4	1.35
Prepared Manure	68.4	4.41	70.16	2.537	0.146	0.095	+286	16.0	0.30

The horse manure 500 appeared well ripened when unearthed from the horn and we observed many chemical changes very much in keeping with the earlier observations with cow-manure 500: increased oxidation with production of nitrate, reduced CO_2 respiration, and lowered pH. So, it appears that the horse manure has gone through a very similar process.

We collected Prep 500 samples prepared from2 different groups of horns from 2 continents (buried in Missouri) and compared it to Prep 500 from Australia. The results are seen in Table 3.

Table 3: Chemical Traits of 500 from horns of different world origin

Sample	Moist-ure	pH	OM %	TKN %	NH3-N %	NO3-N %	CRP	CN	CO2-C
Zimbabwe Horn	85.6	7.25	77.8	2.048	.022	.011	86	22	.80
USA Horn	86.4	7.38	83.4	2.096	.022	.001	5	23	1.00
Australian 500	71.7	4.32	54.7	2.048	.011	.325	291	16	.10

The chemistry traits were variable and only the Australian sample seemed exemplary of excellent Prep500 (with one of the lowest pH and CO2 values recorded). The first two samples showed some anaerobic conditions with little sign of nitrate formation. It is noteworthy to see that nitrate in one sample went from 10 ppm at the beginning to 3,250ppm after treatment undergound. The CO2-respiration rate (rate of decomposition) observed for the Australian sample of 500 was about one-tenth that of the two Missouri samples, which had traits more typical of unprocessed manure. This is not a definitive study to determine which horns or 500 are good or bad, but it does indicate characteristic differences that may be traceable to soils conditions and horn quality.

Discussion

Our chemistry studies have demonstrated that the preparation 500 process is uniquely characterized by aerobic stabilizing factors leading to self-preservation at low pH associated with a pleasant odor. It also shows large differences between various horns. There is strong evidence presented that the greater the weight to volume aspect of the horn, the better the process outcome. We also clearly showed that horns vs. non-horns gives big differences. When we used plastic or glass containers, and treated the manure in the same manner in the same location as other horns, we observed that the resulting material was essentially like fresh, unripened manure.

It is noteworthy that in many samples, particularly where the final appearance was aesthetically pleasing, the majority of the nitrogen and organic matter has been retained, which is actually unusual for composting, where much of the organic content and nitrogen are lost in the process. In some samples we tested, the Preparation 500 -retention of nitrogen exceeded 90%, with an average of 76% in all our studies where data is available from start-to-finish. This retention compares to at best 50-55% with poor horns or artificial containers. Could this fact be an indication for a remarkable composting process just in how the nitrogen process is contained? Certainly from the point of view of the chemical data alone, we think so. Nitrogen conservation is an interesting feature in many of the preparations tested. In normal composting, it is extremely rare that N-retentions of over 75% are found; often it is less than 30%. In fact, “aerobic”composting as normally practiced today is found to lead to huge oxidative losses of carbon and nitrogen , exceeding 80% in some Woods End studies (Brinton, 1997).

In contrast, the biodynamic preparation of manure in the form of 500 leads to a substantially different outcome, and we want to say based on the data alone it represents be the most ideal compost. Here, decomposition appears to be arrested before proceeding as far as we see in composting. Something different has happened than would be expected. Simply looking at the data itself, we gain a sense of a whole process about which we understand very little. Further efforts to illuminate the chemistry involved is likely to prove very rewarding.

Summary

In studying Preparation 500 our major physical/ chemical findings have been:

* Horn quality, as evidenced in the weight/ volume aspect, appears to be very determinative of final quality. Poor horns give results nearly identical to artificial (non-horn) controls.

* Initial manure characteristics do not appear to exert a major influence on the apparent quality. There are large decreases in odor, anaerobic conditions and ammonia during the prep 500 process.

* Favorable preparation results are associated with lowered CO_2-activity and a higher nitrogen retention in the prepared manure.

The diagram that follows enables a visualization of the chemistry changes in preparation 500 from beginning to end.

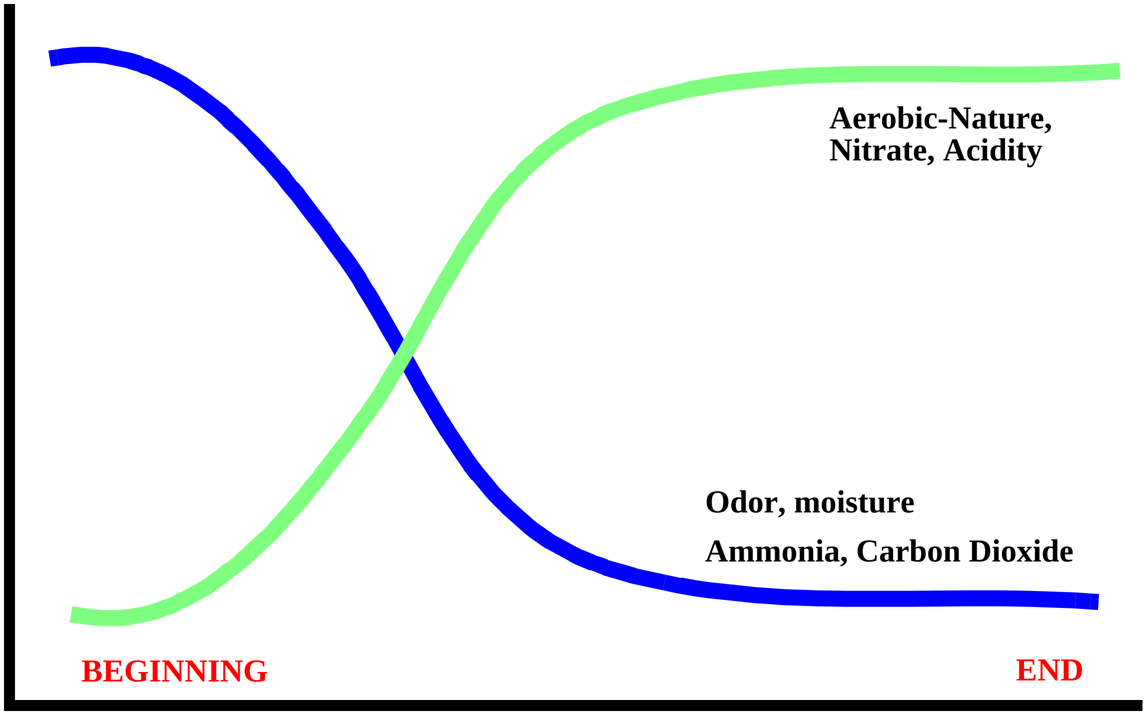

Figure 1. Chemical changes observed during preparation of manure in cow horns underground for Biodyanmic Prep 500

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