Study on the Relationship between Nutrient Release of Wool Sludge Compost and Crops Growth in Textile Industry

陳立學、顏裕鴻

E-mail: 9511429@mail.dyu.edu.tw

ABSTRACT

To make wool sludge transfer to organic fertilizer is another feasible method besides burying or cremating sludge. Wool sludge contains not only the nutrient and organic matters which can provide the needs of plant growth, but also the heavy metal and the toxic matters. The wool sludge which improperly been handled will damage the environment as follows. Firstly, using wool sludge to the plants will create risks. Secondly, wool sludge will cause the biochemistry character change in the soil. In addition, the mineralization of microorganism is also an essential factor. Combined with the modernize compost fermentation process, the sludge may enable to become the excellent quality compost. After using the compost, the organic matter in the soil will be increased, and the microorganism will become more active. Pot experiment and foster experiment have been used in this research to discuss the influence of plant and microorganism by wool sludge. The purpose of pot experiment is mainly to discuss the influence of wool sludge compost nutrient release and the crops growth by using different fertilizer and the different amount in the same nature soil. In the testing process, measuring the nutrient content of nitrogen, phosphorus, potassium, calcium, magnesium in the soil can estimate the compost mineralization speed and the nutrient release situation. Surveying the adult plant birth, recording the weight of plant and the growth condition regularly, and analyzing the residual nutrition ingredient after the pot experiment, each nutrient absorption situation can be estimated. Foster experiment is used to discuss the relationship between wool sludge compost nutrient release situation and soil breath speed in the situation of different fertilizer amount. The result demonstrates that it is no obvious difference between using wool sludge compost and chemical fertilizer to the height and weight of plant. Therefore, the wool sludge may effectively substitute the effect of chemical fertilizer. In addition, combined with the wool sludge compost and chemical fertilizer can express the best growth benefit and the output. The result of foster experiment demonstrates that the soil breath speed is higher in using wool sludge than chemical fertilizer. It may reflect that the continuous release of the nutrient compost is beneficial to the growth of plant. Above all, full utilizing the waste which could become the resource is the important principle to achieve continuous forever uses the Earth. Using wool sludge properly can make the quality of plant better than totally using chemical fertilizer. Simultaneously it may reduce the pollution which industrial reject to ecological environment, and improve the soil acidification phenomenon in Taiwan.

Keywords : wool sludge ; compost ferment ; mineralization ; microorganism activity

Table of Contents

REFERENCES

參考文獻 中文部分 1、王杰、蕭錦。2000。兩性高分子凝聚劑在污泥脫水上的感應研究。工業水處理20(8):p28~30。 2、行政院。2001。全國事業廢棄物管制清理方案。 3、行政院環保署。2000。事業廢棄物清理管制計畫—管制中心第四年計畫。 4、李俊儀。1996。堆肥施用對強酸性土壤氮和磷礦化作用的影響與評估。中興大學土壤環境科學系碩士論文。台中，台灣。 5、吳正宗、曾證諺。2005。有機質肥料的分析方法。94年有機質肥料採樣與檢測方法講習會專刊。第63~74頁。中興大學。台中，台灣。 6、何鋒、周立祥。2004。洗毛廢水蒸餾處理塔中污泥的改性及其對污泥脫水效果的影響。工業水處理25(1):25~28。 7、周昌弘。1995。生物多樣性:觀念、假說及研究。科學月刊26(7):547~553。 8、林良平。1987。土壤微生物學。第171-192頁。南山堂。台北，台灣。 9、林信良。1994。土壤微生物生質量和呼吸量測定方法之探討與應用。中興大學土壤環境科學系碩士論文。台中，台灣。 10、林財旺、張武莉。1993。堆肥腐熟度判定法與利用自產堆肥接種改善堆肥生產效率之研究。八十二年度畜牧污染防治試驗研究計劃成果報告彙編。第137~142頁。台灣省畜產試驗所編印。台灣。 11、林財旺、張武莉。1995。堆肥共同處理場設施功能及堆肥品質評估。八十四年度畜牧污染防治試驗研究計劃成果報告彙編。第173~182頁。台灣省畜產試驗所編印。台灣。 12、林財旺、簡宣裕。1995。農畜產廢棄物利用及堆肥製造之現況。有機質肥料合理施用技術研討會專刊。第43~58頁。台灣省農業試驗所特刊 50。台灣。 13、林晉卿、林財旺、洪嘉謨。1995。添加不同農業廢棄物調整資材對雞糞堆肥品質的影響及其利用。八十四年度畜牧污染防治試驗研究計劃成果報告彙編。第192 ~ 200頁。台灣省畜產試驗所編印。台灣。 14、翁震炘。1998。禽畜糞堆肥處理技術與獸醫公共衛生之探討。國立中興大學獸醫學研究所碩士論文。台中，台灣。 15、陸洪發。1997。禽畜糞堆肥之養分釋放與百和生長關係之研究。中興大學土壤環境科學系碩士論文。台中，台灣。 16、陳仁炫、曾國力、方佳琪、黃譯賢、吳翠茹。2002。禽畜糞堆肥成分特性之檢測及重金屬含量之逆向分析。第五屆畜牧資源回收利用研討會論文集。第82~99頁。畜牧廢棄物資源再生利用協會。台灣。 17、曾證諺。2004。禽畜糞堆肥在兩種不同性質土壤的最佳管理策略評估。中興大學土壤環境科學系博士論文。台中，台灣。 18、黃山內。1991。豬糞堆肥在作物生產之利用。豬糞處理、堆肥製造使用及管理研討會論文專輯。第1~18頁。中興大學。台中，台灣。 19、黃啟民。1995。蔗渣堆肥。堆肥製造與利用。農委會、農林?出版。第11~21頁。 20、黃和炎。1996。推動農作物合理化施肥。台南區農業專訊第28期。第24~25頁。 21、黃裕銘。2005。堆肥化過程中常見的缺失及注意事項。94年有機質肥料採樣與檢測方法講習會專刊。第49~62頁。2005年7月。中興大學。台中，台灣。 22、張瑛蘭。1996。堆肥處理技術概論。經濟部86年度工業污染防治講習會講義。第43~56頁。1996年7月。中興大學。台中，台灣。 23、張照陽。2004。三種不同性質土壤的有機質肥料管理策略之評估。中興大學土壤環境科學系碩士論文。台中，台灣。 24、經濟部。2001。全國整體性特殊事業廢棄物清理計畫（核定本）。 25、楊盛行。1994。堆肥過程中微生物相變化及高溫放線菌之分離及應用。土壤肥料試驗報告。第338~357頁。台灣省政府農林?編印。台灣。 26、楊盛行、鐘仁賜。1995。台灣地區果菜批發市場廢棄物之產出概況，減量及資源再利用探討。農產品批發市場污染防治研究專輯。第5-1~5-33頁。台灣省政府農林?編印。台灣。 27、楊致行。2005。工業廢棄物之回收與資源化。工業技術研究院環境衛生技術發展中心。 28、趙慶祥。2000。資源化技術。第7~8頁。北京化工工業出版社。北京，中國。 29、盧金鎮。1994。雞糞及其堆肥之成分調查分析。中華生質能源學會會誌 13:147~154。 30、環保署。2000。全國事業廢棄物減量、減廢及妥善處理規劃專案工作計畫。環境資源研究發展基金會。 31、環保署。2001。台灣事業廢棄物問題白皮書。台灣工業區廢棄物問題白皮書。 32、羅裕堂。2002。有機栽培下土壤微生物多樣性之碳討。中興大學土壤環境科學系碩士論文。台中，台灣。 33、嚴玉龍。2002。洗毛廢水處理工藝性狀。環境保護2002（2）:20~21。 34、鐘仁賜。1993。酸性土壤中施用有機物對作物生長及鋁錳之解毒作用。台灣東部問題土壤改良研討會論文集。中華土壤肥料學會。第193~217頁。 35、鍾仁賜。2005。有機肥料農地施用常見問題與對策。94年有機質肥料採樣與檢測方法講習會專刊。p24~31。2005年7月。中興大學。台中，台灣。 英文部分 1、Aelion, C. M. and P. M. Bradley. 1991. Aerobic biodegradation potential of subsurface microorganisms from a jet fuel-contaminated aquifer. Applied Environ Microbiol 57:57-63. 2、Amann, R. I., W. Ludwing and K. H. Schleifer. 1995. Phylogenetic identification and in situ detection of individual microbial cells without cultivation. Microb. Reviews 59:143-169. 3、Anderson, J. P. E., and K. H. Domsch, 1987. A physiological method for the quantitative measurement of microbial biomass in soil. Soil Biol. Biochem. 10:215-221. 4、Arteca, R. N., B. W. Poovaiah, and O. E. Smith, 1979. Changes in carbon fixation, tuberization, and growth induced by CO2 application to the root zone of potato plants. Science 205:1279-1280. 5、Atlas, R. A. and R. Bartha. 1993. Microbial Ecology : fundamentals and applications. Benjemin / Cumminhan Publishing Inc. Redwood City, California. 6、Beare, M. H.,C. L. Neely, D. C. Coleman and W. L. Hargrove, 1990. A substrate-induced respiration（SIR）method for measurement of fungal and bacterial biomass on plant residues. Soil Biol.Biochem.22:585-594. 7、Bray, R. H., and L. T. Kurtz. 1945. Determination of total, organic and available forms of phosphorus in soils. Soil Sci. 59:39-45. 8、Bremner, J. M., and C. S. Mulvaney. 1982. Nitrogen-total. In A . L. Page et al. (ed.)“ Methods of soils Analysis. ”Part 2, 2nd edition. Agronomy. 9:595-624. ASA, Madison, WI. 9、Brooker, P. C., A. Landman, G. Pruden, and D. S. Jenkinson, 1985. Chloroform fumigation and the release of soil nitrogen: a rapid direct extraction method for measuring microbial biomass nitrogen in soil. Soil Biol. Biochem. 17:837-842. 10、Bunnell, F. L., D. E. N. Tait, and P. W.

Flanagan, 1977. Microbial respiration and substrate weight loss-II. A model of the influence of chemical composition. Soil Biol. Biochem. 9:41-47. 11、Castellanos, J. Z. and P. F. Pratt, 1981. Mineralization of manure nitrogen-correlation with laboratory indexes. Soil Sci. Soc. Am. J. 45:354-357. 12、Cogle, A. L. and P. G. Saffigna. 1989. Carbon transformation during wheat straw decomposition. Soil Biol. Biochem. 21:367-372. 13、Collins, H. P., L. F. Elliott, R. W. Rickman, D. F. Bezdicek, and R. I. Papendick, 1990. Decomposition and interactions among wheat residue components. Soil Sci. Soc. Am. J. 54:780-785. 14、Diaz-Ravina, M., M. T. Acea, and T. Carballas. 1993. Microbial biomass and its contribtuion to nutrient concentrations in forest soils. Soil Biol. Biochem.25:25-31. 15、Doll, E. C., and R.E.Lucas, 1973. Testing soil for potassium, calcium and magnesium In L. M. Walsh and J. D. Beaton (ed.) Soil Testing and Plant Analysis Soil Science Soc. of Am., Madison, Wis. pp.133-152. 16、Domsch, K. H., T. Beck., J. P. E. Anderson., B. Soderstrom., D. Parkinson, and G. Trolldenier, 1979. A comparison of methods for soil microbial population and biomass studies. Zeitschrift fur Pflanzenernahrung and Bodenkunde 142:520-533. 17、Edwards, N. T., 1975. Effects of temperature and moisture on carbon dioxide evolution in a mixed deciduous forest. Proc. Soil. Sci. Soc. Am. J. 39:361-365. 18、Eghball, B., J. F. Power. 1999. Phosphorus- and Nitrogen-based manure and compost application: Corn production and soil phosphorus. Soil Sci. Soc. Am. J. 63:895-901. 19、Feldmaier, C., 1970. Lilies B.T. Bataford, London. pp.228. 20、Gale, P. M., and J. T. Gilmour, 1986. Carbon and nitrogen mineralization kinetics for poultry litter. J. Environ. Qual. 15:423-426. 21、Garrett, H. E., and G. S. Cox, 1973. Carbon dioxide from the floor of an oak-hickory forest. Soil Sci Am Proc 37:641-644. 22、Garrity, J. B., 1975. In Gladioli for Everyone. David & Charles. pp.16-63. 23、Gilmour, J. T., M. D. Clark and G. C. Sigua, 1985. Estimating net nitrogen mineralization from carbon dioxide evolution. Soil Sci. Soc. Am. J. 49:1398-1402. 24、Golebiowska, J. and Z. Pedziwilk, 1984. CO2 release as an index of biological activity of cultivated soils. Acta Mikrobiologica Polnica 33:249-256. 25、Hagvar, S. 1998. The relevance of the Rio-Convention on biodiversity to conserving the biodiversity of soils. Appl Soil Ecol 9:1-7. 26、Haynes, R. J. 1986. The decomposition process: Mineralization, immobilization, humus formation, and degradation. pp.52-109. in R. J. Haynes(ed) Mineral nitrogen in the plant-soil system. Academic press, New York. 27、He. Z, L., V. C. Baligar, D. C. Martens, and K. D. Ritchey. 1997. Effect of phosphate rock, lime and cellulose on soil microbial biomass in acidic forest soil and its significance in carbon cycling. Biol. Fertil. Soils 24:329-334. 28、Howard, D. W., and P. J. A. Woward, 1993. Relationships between CO2 evolution, moisture content and temperature for a range of soil types. Soil Biol. Biochem. 25:1537-1546. 29、Inbar, Y., Y. Chen, and Y. Hadar, 1990. Humic substance formed during the composting of organic matter. Soil Sci. Soc. Am. J. 54:1316-1323. 30、Jenkinson, D. S., and J. B. Ladd. 1981. Microbial biomass in soils: measurement and turnover. In Soil Biochemistry, Vol. 5 (E. A. Paul and J.N. Ladd, Eds),pp.451-471. Marcel Dekker, New York. 31、Jenkinson, D. S., and D. S. Powlson. 1976. The effects of biocidal treatments on metabolism in soil. V. A method for measuring soil biomass. Soil Biol. Biochem. 8:167-177. 32、Jones, Jr. J. B. 2001. Plant Analysis. In Jones, Jr. J. B. (ed.) “ Laboratory Guide for Conducting Soil Tests and Plant Analysis ” . 3:191-245. CRC Press London New York Washington, D. C. 33、Jorgensen, J. R. and C. G. Wells, 1973. The relationship of respiration in organic and mineral soil layers to soil chemical properties. Plant and Soil. 39:373-387. 34、Keeney, D. R., and D. W. Nelson. 1982. Nitrogen-Inorganic forms. In A. L. Page et al. (ed.) “ Methods of Soil Analysis. ” Part 2, 2 nd edition. Agron. 33:643-698. ASA. SSA. Madison. WI. 35、Knudsen, O., G. A. Peterson, and P. F. Pratt. 1982. Lithium, sodium and potassium. In A. L. Page et al. (ed.) “ Methods of Soil Analysis. ” Part 2, 2 nd edition. Agron. 13:225-246. ASA. SSA. Madison. WI. 36、Lichko, R. P., V. V. Buylov, and V. I. Steputina, 1984. The carbohydrate fraction of organic matter in floodplain soils. Translate from:Pochvovedeniye. (USSR) 2:28-36. 37、Mafongoya, P. L., P. Barak, and J. D. Reed. 2000. Carbon, nitrogen and phosphorus mineralization of tree leaves and manure. Biol. Fertil. Soils 30:298-305. 38、Martens, R., 1987. Estimation of microbial biomass in soil by the respiration method: Importance of soil pH and flushing methods for the measurement of respired CO2. Soil Biol. Biochem. 19:77-81. 39、McLean, E. D. 1982. Soil pH and lime requirement. In A. L. Page et al. (ed.) “ Methods of Soil Analysis. ” Part 2, 2 nd edition. Agronomy. 9:199-224. ASA. SSA. Madison. WI. 40、Mokolobate, M. S. and R. J. Haynes. 2002. Comparative liming effect of four organic residues applied to an acid soil. Biol. Fertil. Soils 35:79-85. 41、Murphy, J., and J. D. Riley. 1962. A modified single solution method for the determination of phosphate in natural waters. Anal. Chem. Acta. 27:31-36. 42、Nadelhoffer, K. J. , 1990. Microlysimeter for measuring nitrogen mineralization and microbial respiration in aerobic soil incubations. Soil Sci. Soc. Am. J. 54:411-415. 43、Nelson, D. W., and L. E. Sommers. 1982. Total carbon, organic carbon, and orhanic matter. In A. L. Page. (ed.) Methods of Soil Analysis. Part 2, 2 nd edition. Agronomy. 9:539-579. ASA. SSA. Madison. WI. 44、Olmeso, P. M., and R. M. Rees. 1999. Short-term N availability in response to dissolved-organic-corbon from poultry manure, alone or in combination with cellulose. Biol. Fertil. Soils 29:386-393. 45、Olsen, S. R., and L. A. Dean, 1965. Phosphorus. In C. A. Black et al (eds). Method of Soil Analysis Part 2. Agronomy 9. Am. Soc. Of Agron., Inc., Madison, Wis. pp.1035-1049. 46、Orchard, V. A., and F. J. Cook, 1983. Relationship between soil respiration and soil moisture. Soil Biol. Biochem. 15:447-453. 47、Patten, D. K., J. M. Bremner, and A. M. Blackmer, 1980. Effects of drying and air-dry storage of soils on their capacity for denitification of nitrate. Soil Sci. Sco. Am. J. 44:67-70. 48、Peech, M., 1965. Hydrogen-ion activity. In C. A. Black et al (eds). Method of Soil Analysis Part 2. Agronomy 9. Am. Soc. Of Agron., Inc., Madison, Wis. pp.922-923. 49、Powlson, D. S., and P. C. brookes, 1987. Measurement of soil microbial biomass provides and early due to straw incorporation. Soil Biol. Biochem. 19:159-164. 50、Schnurer, J., M. Clarholm, and T. Rosswall. 1985. Microbial biomass and activity in an agricultural soil with different organic matter contents. Soil Biol. Biochem. 17:611-618. 51、Selivanovskaya, S.Yu., Latypova, V.Z., Kiyamova, S.N., Alimova, F.K.2001.Use of microbial parameters to assess treatment methods of municipal sewage sludge applied to grey forest soils of Tatarstan。Agriculture,Ecosystems and Environment。Vol: 86. 52、Solbrig, O. T. 1991. From genes to ecosystems : a research agenda for biodiversity. Report of a IUBS-SCOPE-UNESCO workshop. The International Union of Biological Sciences. 51 Boulevard de Montmorency, Pari, France. 53、Stevenson, F. J., 1985. The carbon cycle. In F. J. Stevenson (ed.) Cycle of soil-carbon, nitrogen phosphorus,

sulfur, micronutrients. Wiely, New York. pp.1-44. 54、Summerell, B. A., and L. W. Burgess, 1989. Decomposition and chemical composition of cereal straw. Soil Biol. Biochem. 21:551-559. 55、U.S. Salinity Laboratory Staff.1954 L.A. Richards (ed.) Diagnosis and improvement of saline and alkali soils.U.S.Dep.of Agriculture Handbook no.60. 56、Van Cleve, K., P. I. Coyne., E. Goodwin., C. Johnson, and M. Kelley, 1979. A comparison of four method for measuring respiration in organic material. Soil Biol. Biochem. 11:237-246. 57、West, A. W. and G. P. Sparling, 1986. Modifications to the substrate-induced respiration method to permit measurement of microbial biomass in soil of differing water contents.Microbiol Method 5:177-189. 58、Witter, E., A. M. Martensson, and F. V. Garcia, 1993. Size of the soil microbial biomass in a long-term field experiment as affected by different N-fertilizers and organic manuers. Soil Biol. Biochem.25:659-669.