TANNIN IN COMPOST BASED ON PINE BARK

Mario R. DELFINO[1]; María del C. SARNO[1] y Mirta N. BAEZ [2]

RESUMEN: Se desarrolla un método volumétrico que implica una doble valoración para analizar el contenido en taninos de sustratos vegetales a base de corteza de pino. La bibliografía especializada no contempla su análisis en este tipo de matriz. Se realiza una adaptación de la técnica propuesta por la AOAC referida al tanino presente en té. Mediante la Técnica de Adición Estándar se comprobó la ausencia de interferentes en la matriz. Los resultados mostraron una repetibilidad aceptable ($\sigma = \pm$ 0,04).

ABSTRACT: A volumetric method that involve a doubletitration to analyse the tannin content of vegetables substratum based on pine bark is developed. Specialize bibliography does not regard its analysis in this kind of matrix. An adaptation of technique proposed by AOAC, refered to tannin present in tea is realized. By means of Standard Addition Technique, the absence of matrix interference is proved. Results show an acceptable repeatibility ($\sigma = \pm$ 0,04).

Palabras Claves: tanino, compostado, titulación, estiercol

Key Words: tannin, compost, titration, dung

INTRODUCTION

As compost we know the product of aerobic degradation of vegetables residues outside soil during artificial dung elaboration process.

Usually, the discarded vegetable material is piled up in successive stratums, inserting earth in order to bring humidity and microbial germs that facilitate the descomposition.

Tannin in pine bark retards seeds and shoots growth. It is an inhibitor same as short chain organic acids, aromatic acids and essential oils. Others subtances that show inhibitor propierties are cafeinic acid, ferulic acid, parasorbic acid and cumarine.

A good quality compost contains little or nothingness tannin. Temperature, humidity and acidity of the mix determine the time necesary to decrease the tannin value.

Dificulties to find specific reactions in artificial dung matrix determine the absence of a know tannin descomposition course.

The original value of tannin in *Pinus elliottii, Pinus taeda* and *Pinus patula* Bark, used as vegetables residues in compost elaboration, is inside 4-8% (w/w) interval, depending on nature and age of species, earth characteristics and climate. So that, pines bark are lixiviated with water after grinding. This process spends near twelve weeks for tannin level decreases below 2% and does not show fitotoxicity.

(1) Facultad de Ciencias Exactas y Naturales y Agrimensura (UNNE). Av. Libertad 5460 (3400) Corrientes, Argentina. E-mail: mdelfino@exa.unne.edu.ar

(2) PECOM Forestal. Est."San Jorge". Pto. Bossetti. Libertad, Misiones.

Specialize bibliography does not regard a validate analytic technique for tannin value determination in compost. An adaptation of technique proposed by AOAC, refered to tannin present in tea is realized in the present work.

Purpose

- Get in a modification to 14.048-1449 method proposed by AOAC and optimize the quality parameters (precision, accuracy and no interference from matrix) of the new methodology.
- Reach knowledge around tannin value in compost based on *Pinus elliottii* bark, trace level concentration, in order to predict its quality performance.

Experimental

Samples. Composts were elaborated by a forest company in Misiones province (Argentine) to feed pine shoots. Assays were realized on ten different kind of samples, reported in Table 1. The samples were stored in refrigeration until analysis time.

Materials

Tannin acid standard solution (1mg/mL): 1000 mg tannic acid (USP grade) were dissolved in 1 L of distilled water.
Potasium permanganate disolution: 1,33 g potassium permanganate were dissolved in water and adjusted to 1 L. This solution was titred against 0,2500 g sodium oxalate (analytic grade) dissolved in near 250 mL hot water containing 5 mL sulfuric acid.
The following expression is used:

mL utilized MnO_4K x 0,0268 = mL $C_2O_4H_2$ 0,1N/mL MnO_4K

Carmine indigo solution: 6 g carmine indigo (Eatsman C 1009) were dissolved in water and 50 mL sulfuric acid to 1 L.
Gelatine solution: 25 g gelatine were soaked with sodium chloride saturated solution during 1 h. The mix was heated until disolution and diluted to 1 L with NaCl saturated.
Acid sodium chloride solution: 25 mL sulfuric acid were added to 975 mL NaCl saturated solution.

Technique. As first step, aliquot 40 g compost with 250 mL water are boiled during 30 minutes. 10 mL cooled filtrate are accurately pipeted in 250 mL erlenmeyer, added 5 mL of carmine indigo indicator and 100 mL of water. Titrate this solution with potassium permanganate and bring solution to light yellow end point. Name **A** the potassium permanganate mililiters consumed.
As second step, add 50 mL gelatine solution, 50 mL sodium chloride acid solution and 10 g kaolin powder to 100 mL filtrate. Shake the mix, let state and filter. An aliquot 25 mL filtrate are mixed with 5 mL carmine indigo and 100 mL water. Titulate at the same manner against sodium permanganate solution. Name **B** the mililiters spended.
A – B = mL permanganate necessary to oxide tannin of sample. One mililiter $C_2O_4H_2$ 0,1N be equivalent to 0,0042 g tannin (as tannic acid).

RESULTS

In this work, the average equivalence founded was 2,09 mL $KMnO_4$ = 1,0 mL $H_2C_2O_4$ 0,1 N. The tannin amount in filtrates were analized by triplicate in each sample (see Table 1). Results show acceptable repetibility ($\sigma = \pm 0{,}087$).

The accuracy was determined applying this method to samples to wich 10 mL tannic acid standard solution have been added (Standard Addition Method). The differences between volumes of potassium permanganate spent in original and tannin acid added samples (V_i) are shown in Table 2. Considerating potasium permanganate desirable volume $V_d = 4{,}97$ mL, results an acceptable accuracy and no significative interferences from matrix.

Table 1: Tannin Concentration in pine bark compost (triplicate)

Sample	Tannin (mg/100 g sample)		
100% Compost	38	39	39
100% improve Compost	21	20	21
Peat 100%	110	113	114
Cocosil 100%	235	233	230
85% Decompose bark + 15% Peat	52	50	52
70% Decompose bark + 30% Peat	67	68	67
85% Decompose bark + 15% Cocosil	78	75	77
70% Decompose bark + 30% Cocosil	86	86	87
70% Decompose bark + 30% Perlite	10	10	9
100% Special pine bark	0	0	0

CONCLUSION

- Developed thecnique is sufficient accurate and precise, suitable to purposes.
- Tannin amount in compost known humidity and temperature conditions, treated during different times, resalt the importance of your quantitative analysis.
- Through the thechnique proposed, it can be improve adequate process to lead and accelerate the degradation of vegetables residues in order to secure a major quality product.
- This simple analitycal method is available to be develop for any chemical technician operating in a low complexity laboratory.

Table 2. Titration of 10 ml tannic acid standard solution.

Assay	V_i (mL)	V_i - Vd (mL)
100% Compost	4,9	-0,07
100% improve Compost	5,0	0,03
Peat 100%	4,9	-0,07
Cocosil 100%	4,9	-0,07
85% Decompose bark + 15% Peat	5,0	0,03
70% Decompose bark + 30% Peat	5,1	0,13
85% Decompose bark + 15% Cocosil	5,0	0,03
70% Decompose bark + 30% Cocosil	4,9	-0,07
70% Decompose bark + 30% Perlite	4,8	-0,17
100% Special pine bark	5,0	0,03
		$\sigma = \pm 0{,}087$
		CV = 1,76%

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