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RESEARCH ARTICLE

Soil Cadmium content on Chaponne of Carixien soil series in France comparing with the result on Domerien soil series

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Abstract

Objectives: The present research was carried out in order to know soil cadmium (Cd) availability. **Method:** The researchers present results of analyzing soil Cd contents on a Carixien soil series of a part of Burgundy (in French Bourgongne) in France. And the researchers compared this data on the Carixien soil series with the data on Dubloc (Domerien soil series), the result on Domerien soil has been already published. **Findings:** The pH value on Dubloc and that on Chaponne were very different. On Chaponne the pH changed in big range, while on Dubloc the value ranged little. The Chaponne soil extracted large amount of Cd up to 1440 minutes (24 hours), while the Dubloc soil did in smaller amounts. **Novelty:** The researchers take a hypothesis for this result. On Chaponne soil the 'hole' occurred with the rapid change of pH value, and then from the hole the Cd in the soil continued to be extracted, while there was not 'hole' in the Dubloc soil. But the real reason of 'hole' of the Chaponne soil is not explained until now.

Keywords: Absorbance; Cadmium; Chaponne; Carixien soil; Cd extraction; pH change

1 Introduction

A field case study was undertaken across the southern part of the Yonne district, on a Carixien soil series of a part of Burgundy, France [(1)]. This area of Yonne district has various soil series with either low or high geochemical cadmium (Cd) content in the topsoil. Total Cd content of the surface soil can vary greatly (0.14 – 3.51 ppm Cd (mg Cd /kg soil) depending on soil series and sampling site [(1)]. After this work by Mench et al. [(1)], the researchers carried out the work in order to know the relation between soil weight, amount of an extracting reagent and then extracted Cd from the soil in the Burgundy region in France [(2)]. The experiment time on the work [(2)] was from March 24 to June 23 1998, and the purpose of the work was to know the ratio of

(soil:EDTA) and the extracting time was fixed as 1440 minutes (24 hours). The aim of this present research was to know Cd availability[3,4]. Absorbances for Cd analyses were determined by atomic absorption spectrophotometry[5]. As a second report of this work after Bermond et al. [6] on Domeriem soil, the researchers now present some results of analyzing soil Cd contents on Carixien region of Burgundy in France depending on the change of extraction time.

2 Materials and methods

Soil samples were collected on 0.3 m^2 area with a spade from the 0 to 0.25 m surface ploughed layer in fields at Chaponne on Carixien region of Burgundy, France[1]. Soil samples were air-dried, 2 mm sieved and rehomogenized. And the soil samples from the Carixien soil series were used for the analyses of soil Cd content. The method for extractions were by Lebourg[7] and Ghestem[8]. The time for extraction was from 5 min, 10 min, 20 min, 30 min, 50 min, 1 hour, 2 hours, 3 hours, 5 hours, up to 24 hours for Chaponne soil. And the reagent for extraction was 0.05 M EDTA (ethylene diamine tetraacetic acid) on the form of Na_2H_2EDTA. The soil was extracted in a polyethylene bottle (volume around 50 ml) by an agitator, then filtrated with a Millipore system (radius of membrane, Æ=0.45 mm). The weight of soil and amount of EDTA were 10 g, 30 ml for Chaponne soil. There are three experiments for this report; soil sampling, soil analyses, crop analyses. These experiments of soil sampling and crop analyses were already performed. Now this is the last experiment; soil analyses. And the experiment was carried out on Laboratoire de Chimie Analytique of Institut National Agronomique Paris-Grignon (INA P-G) in France, during a period from October 19 to November 3, 1998 for Chaponne soil. The Cd contents of the extracted soil solution were determined by air-acetylene flame atomic absorption spectrophotometer (AAS) (model: VARIAN SPECTRAA 250 PLUS), and the wave lengths was 228.8 nm. Background correction was used for Cd analysis[9].

3 Results and discussion

Figure 1 showed the change of pH of extracted solution depending upon time. The pH value on Dubloc and that on Chaponne were very different. On Chaponne the pH changed in big range, while on Dubloc the value ranged little. This figure shows the Comparison of pH between Dubloc soil (Domérien soil series) and Chaponne soil (Carixien soil series). From Figure 1, it is considered that Dubloc soil(Domerien soil series) is acidic. While the samples on Chaponne soils (Carixien soil series) are alkaline. The comparison of the two soil series (Domerien and Carixien) is necessary; the ratio of each Cd content per total Cd content.

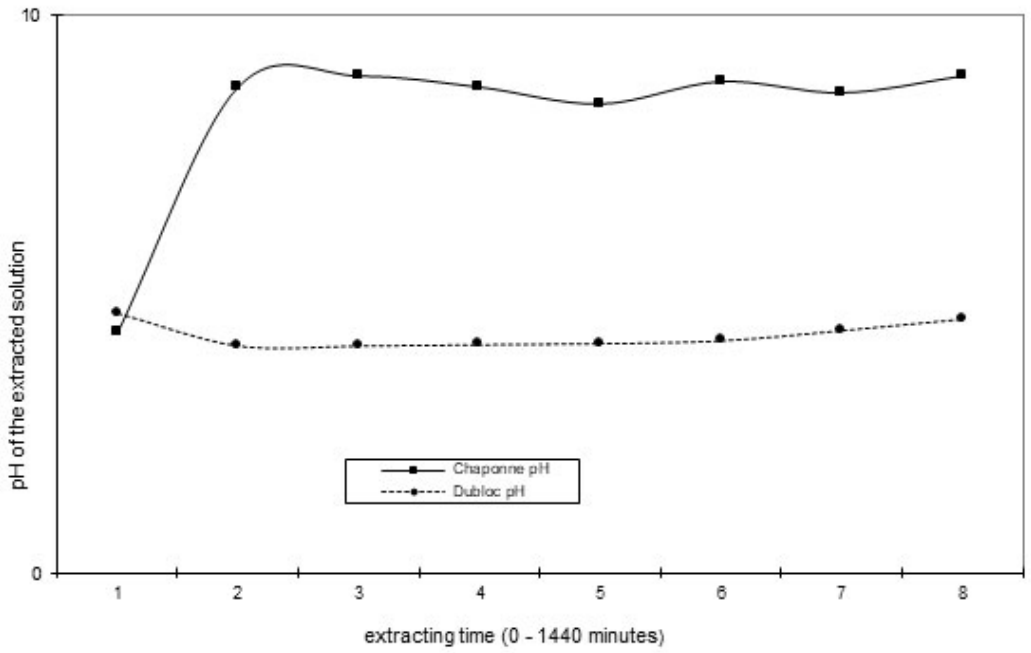

Fig 1. The change of pH of the extracted solution depending on extraction.

Table 1. Absorbance for Cd content of Chaponne (Carixien), calculated by atomic absorption spectrophotometer on back ground correction(BC yes), 10 g soil + 30ml EDTA, (agitated and filtrated from 5 to 6 November 1998)

Time (minutes)	5	10	20	30	60	300	1440
	5	4	5	7	7	8	35
	3	6	4	5	6	6	35
	4	5	7	7	7	9	38
Absorbance (x 0.001)	4	6	7	6	9	9	37
	5	6	7	6	8	9	37
	5	5	5	6	9	9	38
	4	5	7	8	8	10	38
	4	5	5	6	8	7	38
Mean±Standard deviation	4.2±0.7	5.2±0.7	5.8±1.2	6.3±0.9	7.7±1.0	8.3±1.3	37±1.3

Table 1 shows the absorbance for calculating Cd content of Chaponne (Carixien), calculated by Atomic Absorption spectrophotometer on Back ground correction(BC yes), 10 g soil + 30 ml EDTA, (agitated and filtrated from 5 to 6 November 1998). The pH value changed much more on Chaponne than the value did on Dubloc, and there the Cd absorbance through the atomic absorption spectrophotometry and its content increased up to 24 hours extraction. However, pH value changed less, the Cd absorbance and its content maintained similarly during the extraction of 24 hours. The important thing in Table 1 is the big difference of pH value between the value before the experiment (time is 0 minute) and those others (times are 5, 10, 20, 30, 50, 60, 120, 180, 300,1440 minutes.

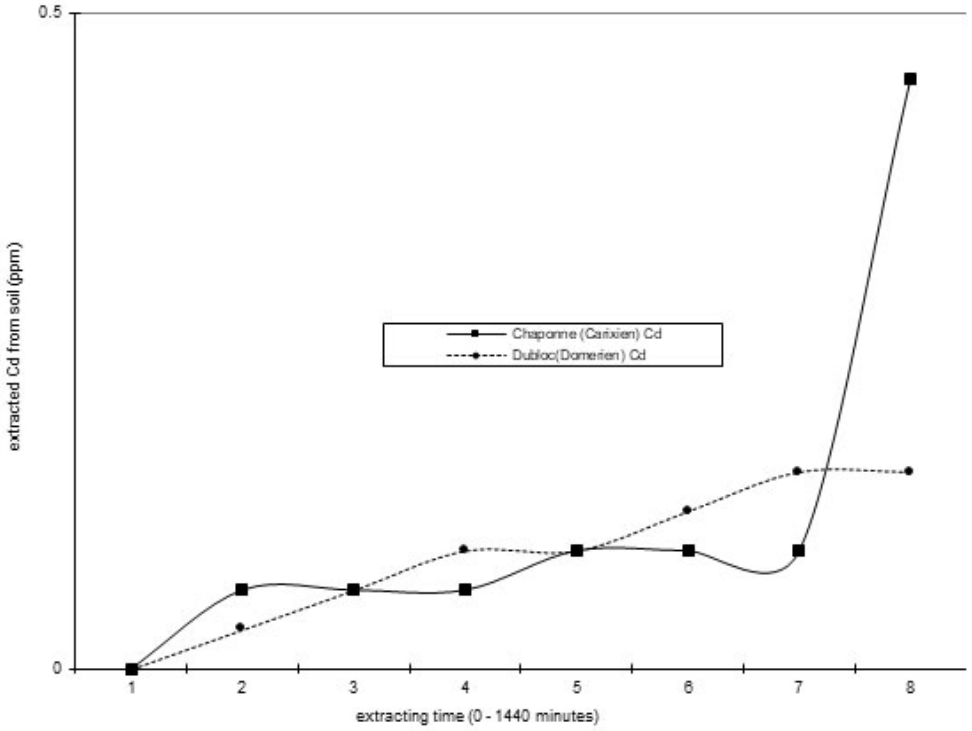

Fig 2. The change of soil Cd content depending on extraction

And Figure 2 showed the change of extracted Cd content from the two soils during extraction during 1440 minutes. The Chaponne soil extracted large amount of Cd up to 1440 minutes, while the Dubloc soil did in smaller amounts. The researchers take a hypothesis for this result. On Chaponne soil the 'hole' occurred with the rapid change of pH value, and then from the hole the Cd in the soil continued to be extracted, while there was not 'hole' in the Dubloc soil. But the real reason of 'hole' of

the Chaponne soil is not explained until now. Here 'hole' indicates the estimation of future capability or potentiality.

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