Agriculture Forest Food

ICAFOF

Çesme-İzmir/Turkey

NEVŞEHİR HACI BEKTAŞ VELİ ÜNİVERSİTESİ 2007

ICAFOF 2018

2-5 April 2018
Cesme-Izmir / Turkey

Proceeding Book

Editors

Asst.Prof.Dr. M.Cüneyt BAĞDATLI

Assoc.Prof.Dr. Erkan KALIPCI

Assoc.Prof.Dr. Serkan ŞAHİNKAYA

Invitation

Welcome to International Conference on Agriculture, Forest, Food Sciences and Technologies (ICAFOF-2018 Çeşme-İzmir/ Turkey). This Three Nights, Four Days conference will be held in Sheraton Cesme Hotel Resort & Spa , Çeşme-İzmir/ Turkey during April 2 - 5, 2018. The official presentation and writing language of the ICAFOF is abstract and Full Papers as English and Turkish will be uploaded to the Conference System. Participants can submit a maximum of two papers for a conference fee for this conference. It will be published as the Conference Proceedıng E-Book only at the end of web page. The ICAFOF, Çeşme-İzmir/Turkey 2018 aims at presenting current researches being carried out in the areas of Agriculture, Forest, Food and Veterinary for scientists, scholars, engineers and students from the universities, technologists, entrepreneurs and policy makers all around the World. Thus, The ICAFOF - Çeşme provides opportunities for the delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration. We hope that you can join us in the ICAFOF - Çeşme 2018 with new insights. We look forward to welcoming you to Çeşme, where is a fascinating nature wonder in Turkey. It will be "KURTALAN EXPRES" Concert for Gala Dinner in ICAFOF. The conference will be organized by Nevşehir Hacı Bektaş Veli University and Galaksi Organizing Company

Conference Chairmen

Asst. Prof. Dr. M. Cüneyt BAĞDATLI

Assoc. Prof. Dr. Erkan KALIPCI

Assoc. Prof. Dr. Serkan ŞAHİNKAYA

Nevşehir Hacı Bektaş Veli University, Turkey

Scientific Committee

Honorable Chair

Prof. Dr. Mazhar BAĞLI (Rector), Nevşehir Hacı Bektaş Veli University, Turkey

Conference Chairmen

Asst.Prof.Dr. M. Cüneyt BAĞDATLI, Nevşehir Hacı Bektaş Veli University, Turkey
Assoc.Prof.Dr. Erkan KALIPCI, Nevşehir Hacı Bektaş Veli University, Turkey
Assoc.Prof.Dr. Serkan ŞAHİNKAYA, Nevşehir Hacı Bektaş Veli University, Turkey

Scientific Committee

Prof. D. Andrey Fılınkov	Agricultural Academy, Russia
Prof. Dr. A. Vahap Yağanoğlu	Atatürk University, Turkey
Prof. Dr. Ahmet Nedim Yüksel	Namık Kemal University, Turkey
Prof. Dr. Alessandro Pıccolo	University of Naples Federico II, Italy
Prof. Dr. Ashraf Mahdy Sharoba	Benha University, Egypt
Prof. Dr. Atilla Yazar	Cukurova University, Turkey
Prof. Dr. Azize Toper Kaygın	Bartın University, Turkey
Prof. Dr. Belgin Çakmak	Ankara University, Turkey
Prof. Dr. Eleni Tsantılı	Agricultural University of Athens, Greece
Prof. Dr. Eric Decker	University of Massachusetts, USA
Prof. Dr. Fatih Özoğul	Cukurova University, Turkey
Prof. Dr. Fatih Selenay	Ankara University, Turkey
Prof. Dr. Fausto Gardini	Agro-Alimentari Università, Italy
Prof. Dr. Halil Kırnak	Adnan Menderes University, Turkey
Prof. Dr. Hasan Degirmenci	Kahramanmaras Sutcu Imam University, Turkey
Prof. Dr. Indrawati Oey	University of Otago, New Zeland
Prof. Dr. İsmet Daşdemir	Bartın University, Turkey
Prof. Dr. Jordi Comas	Universitat Politecnica de Catalunya, Spain
Prof. Dr. Joseph Hella	Sokoine University of Agriculture, Tanzania
Prof. Dr. Kemal Büyükgüzel	Bulent Ecevit University, Turkey
Prof. Dr. Kokini Jozef L.	Purdue University, United States
Prof. Dr. M. Ali Tokgöz	Ankara University, Turkey
Prof. Dr. Mariam Eldeeb	Poultry Nutrition, Egypt
Prof. Dr. Mladen Brncıc	University of Zagreb, Croatia
Prof. Dr. Nadir Ayrılmış	Istanbul University, Turkey
Prof. Dr. Osman Demır	Uludag University, Turkey
Prof. Dr. Osman Erkmen	Gaziantep University, Turkey
Prof. Dr. Pradeep Shrıvasta	Barkatullah University, , India
Prof. Dr. Rajka Bozanıc	Zagreb University, Serbia

Prof. Dr. Ramazan Meral	Bingöl University, Turkey
Prof. Dr. Ravi Sharma	Agra University, India
Prof. Dr. Satyawan Pak	Gadjah Mada University, Indonesia
Prof. Dr. Selçuk Aalbut	Namık Kemal University, Turkey
Prof. Dr. Süha Berberoğlu	Çukurova University, Turkey
Prof. Dr. Şahlan Öztürk	University of Nevsehir Haci Bektas Veli, Turkey
Prof. Dr. Ümit Gürbüz	Selcuk University, Turkey
Prof. Dr. Yeşim Ahi	Namik Kemal University, Turkey
Prof. Krzysztof Surowka	Agricultural University of Krakow,Poland
Assoc. Prof. Dr. Sharon Jean Philippe	
Assoc. Prof. Dr. Anet Rezek Jambrak	University of Zagreb, Croatia
Assoc. Prof. Dr. Aslıhan Esringü	Ataturk University, Turkey
Assoc. Prof. Dr. Bilgin İçel	Çanakkale Onsekiz Mart University, Turkey
Assoc. Prof. Dr. Binod Kydav	Institute of Crop Processing Technology, India
Assoc. Prof. Dr. Branislaw Galik	Slovak University of Agriculture in Nitra, Slovakia
Assoc. Prof. Dr. Cenk Dönmez	Cukurova University, Turkey
Assoc. Prof. Dr. David Rodriguez Lazoro	Universitat de Girona, Spain
Assoc. Prof. Dr. Dündar Yener	Bolu Abant Izzet Baysal University, Turkey
Assoc. Prof. Dr. Fayaj Pathan	MIT College of Food Technology, India
Assoc. Prof. Dr. Halil Barış Özel	Bartın University, Faculty of Forestry, Turkey
Assoc. Prof. Dr. Halil Ibrahim Oğuz	University of Nevsehir Haci Bektas Veli,Turkey
Assoc. Prof. Dr. Hamed Doulati Baneh	Agricultural Research Center, Iran
Assoc. Prof. Dr. Isameldin Bashir Hashim	United Arab Emirates University
Assoc. Prof. Dr. Jordi Saldo Periago	Universitat Autonoma de Barcelona, Spain
Assoc. Prof. Dr. Liviu Olaru	University of Craiova, Romanian
Assoc. Prof. Dr. Mirela Mariana Niculescu	University of Craiova, Romanian
Assoc. Prof. Dr. Mohsen Esmaiili	Urmia University, Iran
Assoc. Prof. Dr. Rosalba Lanciotti	University of Bologna, Italy
Assoc. Prof. Dr. Rosculete Elena	University of Craiova, Romanian
Assoc. Prof. Dr. Sajid Maqsood	United Arab Emirates University, United Arab Emirates
Assoc. Prof. Dr. Vilda Grybauskıene	Lithuanian University, Lithuanian
Asst. Prof. Dr. Anderson de Souza Sant'ana	University of Campinas, Brasil
Asst. Prof. Dr. Barbara Szymczak	West Pomeranian University of Technology, Poland
Asst. Prof. Dr. Bekir Gökçen Mazı	Ordu University, Turkey
Asst. Prof. Dr. Cem Okan Özer	University of Nevsehir Haci Bektas Veli, Turkey
Asst. Prof. Dr. Francisco Barba	University of Valencia, Spain
Asst. Prof. Dr. İlknur Uçak	Nigde Omer Halisdemir University, Turkey
Asst. Prof. Dr. Kemal Şen	Nevsehir Hacı Bektaş Veli University, Turkey
Asst. Prof. Dr. Korkmaz Bellitürk	Namik Kemal University, Turkey
Asst. Prof. Dr. Mariusz Szymczak	West Pomeranian University of Technology, Poland
Asst. Prof. Dr. Marko Petek	University of Zagreb, Croatia
Asst. Prof. Dr. Mohamed Koubaa	Higher School of Organic and Mineral Chemistry, France

Asst. Prof. Dr. Nazir Ahmad Khan	University of Agriculture Peshawar, Pakistan
Asst. Prof. Dr. Osman Gökdoğan	Nevsehir Hacı Bektaş Veli University, Turkey
Asst. Prof. Dr. Sema Ozkadıf	Cukurova University, Turkey
Asst. Prof. Dr. Sema Yaman	Nigde Omer Halisdemir University, Turkey
Asst. Prof. Dr. Vida Sımat	University of Split, Department of Marine Studies, Croatia
Dr. Catalin Dragomır	National Research Development Institute for Animal Biology and Nutrition, Romania
Dr. Pichan Prabhasankar	Central Food Technological Research Institute, India
Dr. Anahita Jabbarı	Urmia University, Iran
Dr. Biljana Kıprovskı	Institute of Field and Vegetable Crops, Serbia
Dr. Charis M. Galanakıs	Research and Innovation Director of Galanakis, Greece
Dr. Concetta Messına	University of Palermo, Italy
Dr. Ilias Gıannenas	Arisotle University of Thessaloniki, Greece
Dr. Jorge M. A. Saraıva	University of Aveiro, Portugal
Dr. Jose M. Lorenzo	Fundacion Centro Tecnoloxico da Carne Ourense, Spain
Dr. Sarita Gajbhiye Meshram	Indian Institute of Technology, India
Dr. Shahin Roohınejad	Federal Research Institute of Nutrition and Food,Germany
Dr. Tugay Ayaşan	Eastern Mediterranean Agricultural Research Institute, Turkey
Hafiz Qaisar Yasın	Strategic Planning and Policy Analyst, Deputy Director, Pakistan
Mag. Neşen Ertugrul, M.A	Alpen-Adria University, Ecology Institute, Austria

Prof. Dr. A. Vahap YAĞANOĞLU	Atatürk University, Agriculture Faculty, Turkey
Prof. Dr. Azize TOPER KAYGIN	Bartın University, Forestry Faculty, Turkey
Prof.Dr. Apostolos Paul Kristakis	Technological Institute of Thessaloniki, Greece
Asst. Prof. Dr. Prithwiraj Jha	Zoology Department, Raiganj Surendranath Mahavidyalaya, India

Invited Speakers

Important Dates

March 11, 2018	Submission Deadline of Abstracts
March 15, 2018	Submission Deadline of Full Text Paper
March 20, 2018	Payment Deadline of Conference Fee
April 2-5, 2018	Conference Date of ICAFOF

Conference Topics

Agriculture Sceinces and Technologies

Land and Water resources, Climate Change, Hydrology, Irrigation, Agricultural Machinery, Agricultural Energy Systems, Agricultural Economy, Horticulture, Plant Protection, Animal Science, Field Crops, Soil Science and Plant Nutrition, Biology, Agricultural Structures, Agricultural Biotechnology, Remote Sensing and GIS, Agriculture Education, Biosystem, Chemistry, Organic Agriculture, Ecology, Fisheries Engineering and etc.

Forest Sceinces and Technologies

Forest Industry Engineering, Forest Engineering, Landscape Architecture, Wildlife Ecology and Management, Wood Mechanics and Technology, Forest Industry and Business Machines, Wood Technology, Chemistry and Technology of Forest Products, Forest Botany, Ecology, Geodesy and Photogrammetry, Watreshed Management, Forest Entomology and Protection Forestry, Forestry Construction, Forest Management, Forest Economics, Forestry Education, Remote Sensing and GIS, Plant Material and Culture, Landscape Planning and Design, Forest Conservation Biology Landscape Techniques and etc.

Food Sceinces and Technologies

Food Chemistry, Food Microbiology, Food Quality Control, Nutrition, Food Engineering Basic Operation, Meat Technology, Garin Processing and Engineering, Milk Processing and Engineering, Biotechnology, Oil Processing and Engineering, Fruit-Vegetable Processing and Engineering, The Packaging of Food, Chemistry, Food Education Food Economics and Industrial Technology and etc.

Veterinary Sceinces and Technologies

Basic Veterinary Sciences, Veterinary Pre-clinical Sciences, Veterinary Clinical Sciencesi, Veterinary Medicine Education, Veterinary Technology, Animals in Folklore, Stock Farming Entity & Economy, Veterinary Medicine History & Deontology, Aquatic Studies, Wildlife Medicine, Medical Biostatistics, Dairy Veterinary Sciences, Livestock Management & Production Technology, Tropical Veterinary Medicine, Experimental Animal Science and etc.

Poster Presentation

Comparison of Documented and Modified Standard Method for Determination of Particle Size Distribution in Soil

Milan PEŠIĆ[1], Sonja TOŠIĆ[1], Aleksandra STANOJKOVIĆ-SEBIĆ[1], Radmila PIVIĆ[1*]

Institute of Soil Science, Belgrade, Teodora Drajzera 7, Serbia
[*]Corresponding Author: drradmila@pivic.com

Abstract

The aim of this paper is to determine the difference between two methods for determination of granulometric composition of the soil, classical International B (documented) and Standard ISO 11277:2009(E) (modified) method. For the analysis, 8 samples from different soil types were analyzed in 7 repetitions in order to compare results. All samples are from the surface horizons. The main differences between these two modified methods are the medium containing the cylinders with samples (air and water), the pipetting time, the number of pipetting and the pipette volume. With the statistical processing of the results, it can be concluded that there is no statistically significant difference in the measurement of fine sand in both methods, however that there is a difference in the measurement of silt and clay. From eight soil analyzes in both methods, four same texture classes were obtained. The obtained results indicate that there is a need for further research or comparison of methods, on a number of samples and on the soil of different textures and different content of organic matter.

Keywords: granulometric composition**,** International B method, Standard ISO 11277, soil types

Introduction

The granulometric composition of the soil, which represents the percentage ratio of particles of sand, dust and clay, is one of the most important physical properties of the soil. The content of the particles is determined by the law of sedimentation- Stokes’s law, which determines the rate of movement of the particles in the suspension. According to Loveland and Whalley, 2001, there are about 400 methods for determining the granulometric composition of the soil. Each of those methods has advantages or disadvantages depending of texture classes, therefore, most commonly applied methods are those that combine the procedures sieving and sedimentation. Most of the soil particle classification by size is based on Atteberg's classification, according to which clay particles are those of less than 0,002 mm, powder 0,002-0,05 mm and sand 0,05-2 mm.

INTERNATIONAL CONFERENCE ON
AGRICULTURE, FOREST, FOOD
SCIENCES AND TECHNOLOGIES
2-5 April 2018 Cesme-Izmir/Turkey

Poster Presentation

Comparison of Documented and Modified Standard Method for Determination of Particle Size Distribution in Soil

Milan PEŠIĆ[1], Sonja TOŠIĆ[1], Aleksandra STANOJKOVIĆ-SEBIĆ[1], Radmila PIVIĆ[1*]

Institute of Soil Science, Belgrade, Teodora Drajzera 7, Serbia
[*]Corresponding Author: drradmila@pivic.com

Abstract

The aim of this paper is to determine the difference between two methods for determination of granulometric composition of the soil, classical International B (documented) and Standard ISO 11277:2009(E) (modified) method. For the analysis, 8 samples from different soil types were analyzed in 7 repetitions in order to compare results. All samples are from the surface horizons. The main differences between these two modified methods are the medium containing the cylinders with samples (air and water), the pipetting time, the number of pipetting and the pipette volume. With the statistical processing of the results, it can be concluded that there is no statistically significant difference in the measurement of fine sand in both methods, however that there is a difference in the measurement of silt and clay. From eight soil analyzes in both methods, four same texture classes were obtained. The obtained results indicate that there is a need for further research or comparison of methods, on a number of samples and on the soil of different textures and different content of organic matter.

Keywords: granulometric composition, International B method, Standard ISO 11277, soil types

Introduction

The granulometric composition of the soil, which represents the percentage ratio of particles of sand, dust and clay, is one of the most important physical properties of the soil. The content of the particles is determined by the law of sedimentation- Stokes's law, which determines the rate of movement of the particles in the suspension. According to Loveland and Whalley, 2001, there are about 400 methods for determining the granulometric composition of the soil. Each of those methods has advantages or disadvantages depending of texture classes, therefore, most commonly applied methods are those that combine the procedures sieving and sedimentation. Most of the soil particle classification by size is based on Atteberg's classification, according to which clay particles are those of less than 0,002 mm, powder 0,002-0,05 mm and sand 0,05-2 mm.

ISBN ICAFOF 978-605-137-479-6

Most often, the combination of sieving and pipetting is used to determine certain fractions (Gee and Bauder, 1986). Technological improvements have also developed other methods of determination such as the laser diffraction method (Cooper et al., 1984; Buurman et al., 1997). The method of sedimentation and pipetting according to Syvitsky et al., 1991, has several important drawbacks: the long duration of the analysis, as well as the great influence of the laboratory equipment and the technicians conducting the analysis.The aim of this paper is to determine whether there is a difference in the result of determining the granulometric composition of different types of soil determined by the documented and standard ISO 11277 method for determination.

Material and methods

In the determination, 8 samples of different soil types (Table 1.) were used from the area of the Pomoravlje district in central Serbia. For each sample, 7 repetitions of analysis were made to obtain statistically significant results. All samples are from the surface horizons.

Table 1. Informations of taken soil samples

No. profile	location	coordinates		Soil type
		X	Y	
1175/16	Village Vinorača (Municipality of Jagodina)	518133	4867123	Eutric cambisol, vertically on a carbonate substrate
1183/16	Agriculture school (Municipality of Rekovac	507682	4855615	Semiglay - Meadow soil, non-carbonate soil
1187/16	Village Trnava (Municipality of Jagodina)	519887	4866458	Humogley - carbonate soil
1199/16	Village Ursule (Municipality of Rekovac)	509624	4856500	Fluvisol - alluvial deposits on humogley
1215/16	Village Stenjevac (Municipality of Despotovac)	542816	4881028	Colluvial soils on slate
1220/16	Village Panjevac (Municipality of Despotovac)	542482	4883901	Luvisol - Brown illimerized soil
1224/16	Village Medveđa (Municipality of Despotovac)	530215	4887712	Pseudogley, Stagnosol ili Epigley
1228/16	Village Veliki Popović (Municipality of Despotovac)	528908	4886074	Vertisol

Before the start of the analysis, the soil samples were prepared according to the ISO standard 11464:2006(E). They were dried to the dryness in the oven, minced into a mill and sieved through a sieve of a diameter of 2 mm.

Both methods used for this research are based on four key processes: dispersion, wet sieving, sedimentation and pipetting. Dispersion is almost always in an alkaline solution, most commonly sodium hexametaphosphate buffered to about pH 9,5 with sodium carbonate or ammonia solution (Smith and Mullins, 2000).

The method of wet sieving through the sieve is used for the extraction of sand particles. Since all mesh sieves are of square shape, geometry and particle orientation have an important role in determining the granulometric composition of the soil (Allen and Baudet, 1977; Matthews, 1991; Xu, 2002). Sedimentation is based on the following facts: the sedimentation rate is constant, the soil particles are rigid, square and smooth, the density of the soil particles is equal to the quartz density of 2.65 gcm^{-3} and the interaction between the particles and the cylinder is negligible, the particles have no effect on the viscosity of liquid (Perković et al., 2013). The pipetting method is used to determine clay and silt fractions, and is based on Stokes's law. Stokes's law determines the rate of movement of the particles in the suspension (Gee and Or, 2002).

For the determination of granulometric composition of the soil according to the International B method, 10 g of the sample prepared according to the ISO standard 11464:2006(E) is required. The sample is transferred to the Erlenmeyer flask with 25 ml of Na-pyrophosphate and 225 ml of distilled water, shaken for one day and left to overnight. The next day, the sample is warmed to boiling on the hot plate and leaved to cool. After cooling, it is transferred to a normal 1000 ml vessel through a 0,2 mm diameter mesh.

On the third day, the sample is pipetted. The cylinder with the suspension of the soil must be closed with the cap and shaken turning the entire cylinder on both sides one minute. By this method we have two pipetting. According to Stokes's law particles equivalent diameter of 0,02 mm (silt and clay), at a temperature of 20°C, the 10 cm long way passes for 4 minutes and 48 seconds in process of sedimentation. Therefore first pipetting will be after 4 minutes and 48 seconds at the depth of 10 cm. The second pipetting will be exactly 4h after the shaking at the depth of 5 cm. Porcelain cups with samples are evaporated on a water bath at 105 °C. The sieves are drying in the oven at 105±5 °C until the next day and their content is a fraction of fine sand. The porcelain cups must be removed from the oven and placed in desiccator for cooling.

The content of coarse sand is calculating by the formula:

$$P=b/m \times 100,$$

P – the content of coarse sand (%),
b – weight of particles >0,2 mm (g),
m - weight of the samples taken for mechanical analysis (10 g),
100 - coefficient for conversion to 100 g of soil.

The content of certain fractions obtained by pipetting is calculating by the formula:

$$X=(m_x-a)\times 1000\times 100/V\times m,$$

X - the content of certain mechanical fraction (%),
m_x – weight of fraction obtained by pipetting (g),
a – weight of Na-pyrophosphate (0,68 g),
1000 - coefficient for conversion to 1000 cm^3,
100 - coefficient for conversion to 100 g of soil.

For the determination of granulometric composition of the soil according to the Standard ISO 11277:2009(E) modified method, 10 g of the sample prepared according to the ISO standard 11464:2006(E) is required. Before the dispersion process, and the sedimentation it's required to make the oxidation of organic matter and the removal of soluble salts and gypsum in order to reduce their impact on the results. For the purposes of this research, these steps are skipped in both methods. The sample is transferred to the Erlenmeyer flask with 150-200 mm total water volume. It's required more 25 ml of Na-pyrophosphate to the flask (dispersing agent). After cooling, sample is transferred to a normal 1000 ml vessel through a 0,2 mm diameter mesh (Standard ISO 11277:2009(E) requires 0,063 mm diameter mesh however in this research for better comparing we used 0,2 mm diameter mesh). On the third day, the sample is pipetted. The cylinder with the suspension of the soil must be closed with the cap and shaken turning the entire cylinder on both sides one minute. By this method we have three pipetting. The cylinder is placed vertically in a pool with a constant temperature, so that it is ready for pipetting. The time of pipetting depends on the temperature of the pool (the higher the temperature, the faster the sedimentation and the time of pipetting). At the first pipetting the pipetting depth is 200 mm, with each next 100 mm. Pipet should be washed well after each pipetting to avoid mixing the samples. Porcelain cups with samples are evaporated on a water bath at 105 °C. The sieves are drying in the oven at 105±5 °C until the next day and their content is a fraction of fine sand. The porcelain cups must be removed from the oven and placed in desiccator for cooling. This method requires a single cylinder without a sample for a blank test to determine the amount of the dispersing agent in the pipette.

Calculations of certain fractions:

$$mf_x = ms_x \times 1000 / V_p,$$

mf_x - the mass of solid in suspension in 1000 ml (g),
ms_x - the mass of material from the x-th pipette sampling (g),
Vp – the calibrated volume of the pipette (20 ml),
1000 – the volume of vessel (ml)

$$m_d = m_r / V_p \times 1000,$$

m_d – the mass of a dispersing agent in the pipette (g),
m_r - the mass of residue (g),
V_p – the calibrated volume of the pipette (ml),

$$m(0{,}2\ mm\ to\ 0{,}02\ mm) = m_{f1} - m_{f2},$$
$$m(0{,}02\ mm\ to\ 0{,}002\ mm) = m_{f2} - m_{f3},$$
$$m(>0{,}002\ mm) = m_{f3} - m_d,$$

m_{f1} – fraction <0,2 mm
m_{f2} – fraction <0,02 mm
m_{f3} - fraction <0,002 mm

Table 2 shows the basic differences between these two methods. Purposely, a minimum difference was made between these two modified methods to see the results difference. One of the main differences is in the medium containing the cylinders with samples. Another big difference is in pipetting time. In International B modified method, the analysis temperature is always 20 °C, and the pipetting time is constant, however in the Standard ISO 11277:2009(E) modified method, the pipetting time changes depending on the temperature of the medium, i.e. water. Number of pipetting and calculations of percentage fractions are the third fundamental difference in these two methods.

In the International B modified method, there are 2 pipetting and the fraction of fine sand is obtained by adding up to 100%; however in Standard ISO 11277:2009(E) method there is 3 pipetting. It should be noted that these are surface samples so that higher content of organic matter can be expected which could affect the results. For this reason it is proposed pretreatment with H_2O_2, anywise Di Stefano et al. (2010) states that in samples where there is no pre-treatment with H_2O_2 there is no statistically significant difference in silt and clay fractions in relation to samples with pre-treatment. Shein et al. (2006) found that there is no difference between analyzes with and without pre-treatment with H_2O_2 in clay and silt fractions.

Table 2. The main differences between two methods

Procedure	International B - modified	ISO 11277:2009(E) - modified
Soil sample	10 g	10 g
Pretreatment with H_2O_2	No	No
Disperse agent	$Na_4P_2O_7$* $10H_2O$	$Na_4P_2O_7$* $10H_2O$
Dispersion process	warming on hot plate	warming on hot plate
Volume cylinder	1000 ml	1000 ml
Volume pipette	10 ml	20 ml
Environment	Air	Water
Pipette time	Constant	Depend about temp.
Number of pipetting	2	3
Calculation of fine sand	the remainder of 100% and other fractions	by calculating the pipetted suspension

The IBM SPSS v22.0 software package was used for statistical interpretation of data.

Research Findings and Discussion

Table 3 shows the comparative values for both methods. The mean values (7 repetitions) of the fractions obtained by the Standard ISO 11277:2009(E) modified method and values of fractions obtained by the International B modified method in one analysis are shown. Based on the values in the table, it is clear that higher percentages are obtained in the International B modified method.

Table 3. Each fraction results obtained with ISO 11277:2009(E) – modified and International B – modified methods documented

No. of sample	standard	international	standard	international	standard	international
	0,2-0,02 mm		0,02-0,002 mm		<0,002 mm	
1175/16	30,68	31,30	26,14	21,80	37,09	46,30
1183/16	32,12	39,60	21,89	23,70	29,15	32,10
1187/16	33,31	55,50	13,33	14,30	16,71	16,10
1199/16	21,67	20,70	37,01	43,10	31,51	34,00
1215/16	35,28	49,70	22,69	26,30	12,59	15,70
1220/16	32,36	32,40	31,72	40,10	22,02	23,00
1224/16	35,83	41,10	22,05	28,80	21,14	22,20
1228/16	33,79	30,90	28,47	36,30	26,21	28,10
Mean	31,88	37,65	25,41	29,30	24,55	27,19
Median	32,84	36,00	24,42	27,55	24,12	25,55
Std.Dev.	4,45	11,21	7,18	9,84	8,04	10,24
Variance	19,83	125,75	51,61	96,85	64,59	104,85

For the statistical interpretation of the results, parametric techniques were used, because after checking Shapiro-Wilk statistics the assumption of the distribution normality were accepted. By applying the Pearson coefficient of correlation (Table 4), a very high positive correlation and significant was found for silt ($r = 0{,}919$) and clay ($r = 0{,}978$), however high positive and not significant for fine sand ($r = 0{,}703$; $p = 0{,}052 > 0{,}05$).

Table 4. Two-tailed correlation between same size fraction in ISO 11277:2009(E) – modified and International B – modified method documented

		N	Correlation	Sig.
Pair 1	Fine sand standard & fine sand international	8	0,703	0,052
Pair 2	Silt standard & silt international	8	0,919	0,001
Pair 3	Clay standard & clay international	8	0,978	0,000

Based on the results of the paired T test (Table 5), it is clear that there isn't a significant difference between the fine sand fraction measured by both methods ($p = 0{,}102 > 0{,}05$), anywise between silt ($p = 0{,}038 < 0{,}05$) and clay ($p = 0{,}038 < 0{,}05$) the opposite.

Table 5. Paired T test for all samples measured with both methods

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Int. of the Difference				
				Lower	Upper			
1 Fine sand standard – Fine sand intern. B	-5,77000	8,67996	3,06883	-13,02663	1,48663	-1,880	7	0,102
2 Silt standard – Silt international B	-3,88750	4,29896	1,51991	-7,48152	0,29348	-2,558	7	0,038
3 Clay standard – Clay international B	-2,63500	2,92480	1,03407	-5,08019	0,18981	-2,548	7	0,038

Based on the obtained results, the textural composition of the soil based on the textural triangle was determined. According to ISO 11277:2009(E), the size of the main fractions are: fine sand (0,2-0,063 mm), silt (0,02-0,0022 mm) and clay (<0,002 mm), however for the purposes of this study, wet sieving was carried out through a 0,2 mm diameter mesh sieve so that the size of the fractions is equal in both methods. Hence, now in both methods the fractions are of the size: fine sand (0,2 – 0,02 mm), silt (0,02-0,002 mm) and clay (<0,002 mm). If the results of the Standard ISO 11277:2009(E) modified method were presented on the FAO texture triangle, then the texture class should be determined based on the most reliable results: fraction of clay and silt. It can be expected that the results of clay and silt are the most reliable since in both methods the percentages of clay and silt are calculated by pipetting of the suspension, and not, as is the case with fine sand in the International B method adding up to the 100 percent.

Results and Suggestions

Due to this method of determining the texture classes in the FAO diagram, it is expected that the results obtained by the Standard ISO 11277:2009(E) modified method will be shifted to the left in relation to the results of the International B method (Figure 1.).

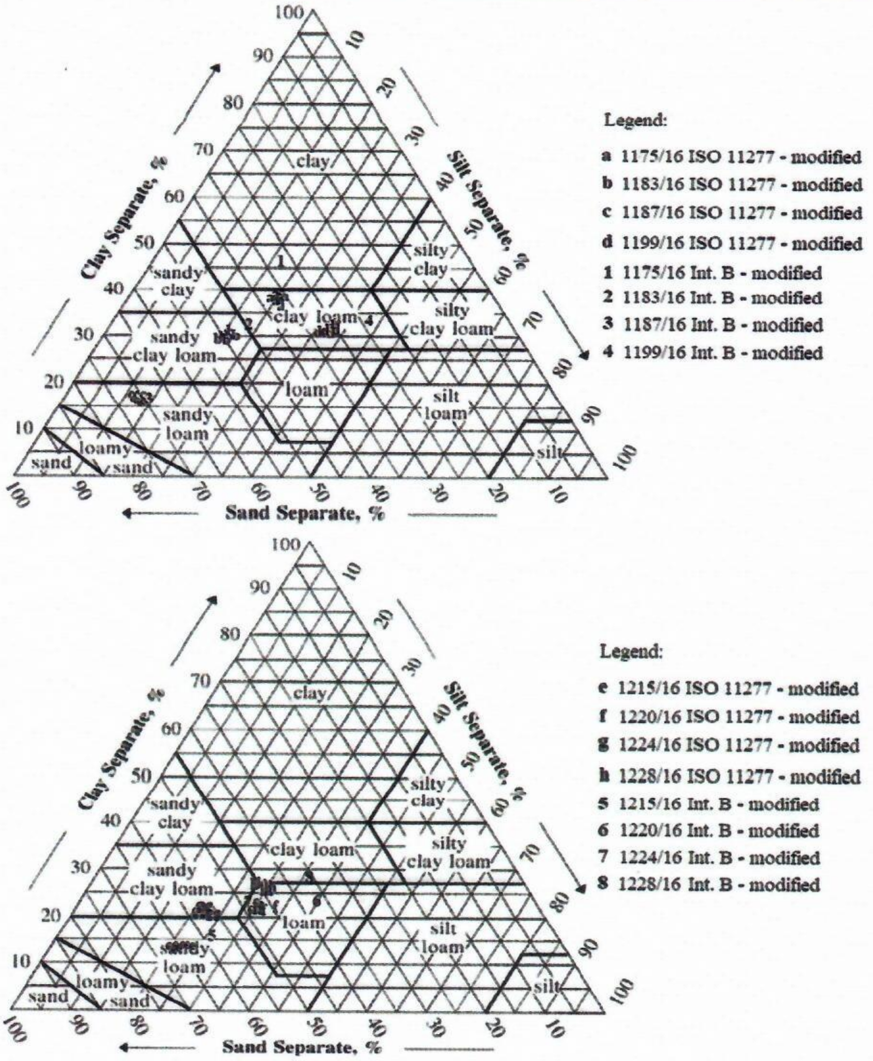

Figure 1. FAO texture triangle with complete results of both modified methods

With the statistical processing of the results, it can be concluded that there is no statistically significant difference in the measurement of fine sand in both methods, anywise that there is a difference in the measurement of silt and clay. From eight soil analyzes in both methods, four same texture classes were obtained.

The obtained results indicate that there is a need for further research or comparison of methods, on a number of samples and on the soil of different textures and different content of organic matter.

Acknowledgements

This research is partially supported by Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant No. TR 37006.

References

Allen, T., Baudet, M. G., 1977.The limits of gravitational sedimentation, Powder Technolgy 19, pp. 131-138.

Barth, H. G., and Sun, S. T., 1985. Particle size analysis, Anal. Chem, 57:151R-175R.

Buurman, P., T. Pape, C. C Mugler, 1997: Laser grain-sizedetermination in soil genetic studies. 1. Practical problems, Soil Science 162, pp. 211–218.

Cooper, L. R., Haverland, R. L, Hendricks, D.M., Knisel, W. G., 1984: Microtac particle-size analyzer: an alternative particlesize determination method for sediment and soils, Soil Science 138, pp. 138-146.

Di Stefano, C. Ferro, V. Mirabile, S., 2010. Comparison between grain-size analyses using laser diffraction and sedimentation methods, Biosystem engieneering 10, pp. 205–215.

Gee, G. W., Or, D., 2002. Particle-size analysis. In: J. H. Dane & G. C. Topp (Eds.), Soil Science Society of America Book Series: Vol. 5, Methods of soil analysis. Part 4. Physical methods, pp. 255–293.

Hadžić, V., Belić, M., Nešić, Lj., 1997. Metode istraživanja i određivanja fizičkih svojstava zemljišta, Jugoslovensko društvo za proučavanje zemljišta, Komisija za fiziku zemljišta, pp. 17-32, Novi Sad

International Standard 11277:2009(E), Soil quality-Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation, Second edition 2009-09-15.

International Standard 11464:2009(E), Soil quality-Pretreatment of samples for physico-chemical analysis, Second edition 2006-07-01.

Loveland, P. G., Whalley, W. R, 2001: Particle size analysis. In: Smith K.A, Mullins C.E. (eds.): Soil and Environmental Analysis. Physical Methods. Marcel Dekker, Inc., New York.

Matthews, M. D., 1991. The effect of grain shape and density on size measurement. In: Principles, Methods, and Application of Particle Size Analysis. J. P. M. Syvitski (ed.) Cambridge University Press, New York, NY, pp. 22–33.

Perković, I., Pernar, N., Bakšić, D., 2013. Comparison of two sieving and sedimentation methods for determination of particle size distribution – possibilities and limitations of interpretation, Šumarski list, Zagreb, pp. 567–574.

Shein, E. V., Yu, E., Milanovskii, Molov, A. Z., 2006. The Effect of Organic Matter on the Difference between Particle-Size Distribution Data Obtained by the Sedimentometric and Laser Diffraction Methods ISSN 1064-2293, Eurasian Soil Science, 2006, Vol. 39, Suppl. 1, pp. 84–90.

Smith, K.A, Mullins, C.E., 2000. Soil and Environmental Analysis. Physical Methods. Second Edition Revised and Expanded. Marcel Dekker, Inc., New York, pp 281-314.

Syvitski, J. P. M., LeBlanc, K. W. G., Asprey, K. W., 1991. Inter laboratory, instrument calibration experiment. In: Principles, Methods, and Application of Particle Size analysis (Ed. by J. P. M. Syvitski), Cambridge University Press, Cambridge, pp. 119– 128.

Xu, R., 2002. Particle Characterization: Light Scattering Methods. Kluwer Academic Publishers, New York, NY.