

Influence of the purification of bentonite clay from new deposits in the state of Paraíba-Brazil for use in water-based drilling fluids

(Influência da purificação de argilas bentoníticas dos novos depósitos do estado da Paraíba-Brasil visando seu uso em fluidos de perfuração base água)

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Abstract

Bentonite clay is used all around the world as an additive in drilling fluids. However, impurities present in this material can compromise the compatibility of the clay-fluid system. The present study aimed to analyze the effects of the purification of bentonite samples from new deposits in the state of Paraíba, Brazil, in order to make them usable in water-based drilling fluids. The samples were first purified by centrifugation, and their characteristics were determined using the following techniques: laser granulometry, X-ray diffraction, chemical analysis, cation exchange capacity, thermogravimetric analysis, and differential thermal analysis. After these determinations, the polycationic clay samples were made sodic through the addition of sodium carbonate (Na_2CO_3) in the proportion of 125 meq/100 g of dry clay. The rheological and filtration properties (apparent viscosity, plastic viscosity, and filtrate volume) were then tested. The results showed that the purification process was efficient for removing accessory minerals such as quartz, iron, and carbonates. With regard to rheological and filtration properties, the results following centrifugation showed that the material can be suitable for use in water-based drilling fluids.

Keywords: bentonite, rheology, drilling fluids, clay purification.

Resumo

As argilas bentoníticas são usadas em todo o mundo como aditivos para fluidos de perfuração; no entanto, impurezas presentes nessas argilas podem comprometer a compatibilidade do sistema argila-fluido. Assim, este trabalho teve por objetivo analisar a influência da purificação de argilas bentoníticas dos novos depósitos do estado da Paraíba, visando seu uso em fluidos de perfuração base água. Inicialmente as argilas foram purificadas através do processo de centrifugação, em seguida foram caracterizadas por meio das seguintes técnicas: granulometria a laser, difração de raios-X, análise química, capacidade de troca de cátions, análise termogravimétrica e térmica diferencial. Após caracterização, as argilas policationicas foram transformadas em sódicas com aditivação de carbonato de sódio (Na_2CO_3) na proporção de 125 meq/100 g de argila seca. As propriedades reológicas e de filtração foram: viscosidade aparente, viscosidade plástica e volume de filtrado. Os resultados evidenciaram que o processo de purificação foi eficiente na redução dos minerais acessórios, como quartzo, ferro e carbonatos. Em relação às propriedades reológicas e de filtração, os resultados se mostraram adequados após tratamento por centrifugação para uso em fluidos de perfuração base água.

Palavras-chave: bentonita, reologia, fluidos de perfuração, purificação de argila.

INTRODUCTION

Clay in general, and bentonite specifically, has played an increasingly important role in a variety of industries. This is because its composition and structure give it specific properties that make it useful in many different industrial applications, responsible for the movement of hundreds of millions of dollars in the global economy every year. Among these applications, this study draws attention to its use in drilling fluids [1, 2]. Drilling fluids are primary suspensions of water and bentonite which play an essential

role during the drilling of wells [3, 4]. Bentonite has been used for many years as a suspension agent in the composition of water-based drilling fluids for oil wells and has a number of different uses throughout the process. The success of the drilling of a well depends, among other factors, on the physical and chemical features of the drilling fluid used in the operation [5-7]. Drilling fluids must be designed with several characteristics in order to enhance drilling efficiency. Their compositions are chosen to meet these characteristics, such as appropriate viscosity, gel-like consistency, filtrate control, plaster, inhibition of hydratable clay from geological formations, and lubrication coefficient [8-10].

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In order to be used as a component of drilling fluids for oil wells, bentonite must be sodic, with a high swelling capacity. However, bentonite found in Brazil is polycationic, and often contains other clay minerals, such as illite, kaolinite, and chlorides, as well as considerable amounts of non-clay components, as quartz and feldspar. Because sodic bentonite has a greater swelling capacity, responsible for the viscosity and formation of a low-permeability filtration layer, the presence of other minerals has an adverse effect on the quality of this material [11]. Drilling fluids are usually very sensitive to the presence of mineral impurities, with the plastic and apparent viscosities and filtrate volume being the properties most adversely affected. The purification process is normally performed to eliminate non-clay materials, such as salts and non-soluble minerals, and non-suspended clay particles, serving to concentrate only the clay portion and make its rheological properties more stable and controllable [12, 13]. Purification is a necessary and critical stage that guarantees the reproducibility of results and give bentonite the characteristics that make it suitable for industrial applications [14].

Centrifugation is one of the methods used to purify/concentrate a clay sample without causing significant alterations to its physical or chemical properties. This procedure involves the suspension of the sample in deionized water and disaggregating it by centrifugal force in order to extract fractions with finer sized particles. Clay minerals are naturally extremely fine, and this characteristic can be used to separate them from other minerals that they are normally found with [15]. There has been considerable research in the literature concerning the purification of clay through centrifugation. This method was tested in [16-19] with several clay samples for different times and speeds. The best separation for clay fractions $x < 2 \mu\text{m}$ was achieved by centrifugation at 8000 rpm for 40 min [15]. Several granulometric treatments and chemical processes for the purification of bentonite samples from Vietnam were tested; the purest bentonite was achieved by means of centrifugation and sonication [20]. A simple method for purification of clay was analyzed, with tests showing that centrifuge speed influences the purification process of bentonite; low speeds reduce the purification level and high speeds reduce the performance of montmorillonite [21]. Research studies involving the purification of clay by the hydrocyclone method have been developed at the Federal University of Campina Grande (UFCG), with special mention of [22-26], in which the efficiency of this method was confirmed for several different applications.

Every industrial or academic application of bentonite demands materials with specific properties which can only be obtained through a strict selection of the raw material supplied by mining companies and through appropriate processing and purification. Therefore, the present study aims to analyze the outcome of the purification of bentonite samples coming from new deposits in the state of Paraíba, Brazil, by centrifuge, focusing on their suitability for use in water-based drilling fluids.

MATERIALS AND METHODS

Polycationic bentonite samples from new deposits located in the state of Paraíba, Brazil, were studied, with the following identification codes: samples AM1 and AM2 from the town of Sossego, sample AM3 from the town of Olivedos, and sample AM4 from the town of Cubati. After being treated in the centrifuge, the samples were called: AM1P, AM2P, AM3P, and AM4P. The additive used in the present study was sodium carbonate (Na_2CO_3) and the deflocculant ammonium hydroxide (NH_4OH) for the purification treatment, both produced by Vetec, P.A.

The samples were purified through the use of a centrifuge. In the first purification stage, the natural samples were dried in a stove at 60°C and then ground in a ball mill. Following that, the samples were passed through an ABNT N° 200 sieve (0.074 mm). To prepare the suspensions for the centrifuge, 25 g of clay was used, mixed with 500 mL of deionized water and 25 mL of ammonium hydroxide (NH_4OH), 30% at solution. The suspensions were then shaken at a rate of 17000 rpm for 20 min and kept at rest for 7 days. Following this, the suspensions were shaken again at 17000 rpm for 20 min. Then, the suspensions underwent the centrifugation process, using the Fanem Baby Centrifuge 206, at different speeds for 5 min. The floating suspension material was collected, dried, processed, and characterized. After several tests, a centrifuge speed of 1900 rpm for 5 min was chosen, as this was the configuration that obtained the best results.

The characterization of the natural and treated samples was done by: determination of particle size distribution by laser diffraction using Cilas equipment (GA, 1064); cation exchange capacity (CEC) determined by methylene blue adsorption method described in [27]; X-ray fluorescence (EDX 720, Shimadzu); X-ray diffraction (XRD 6000, Shimadzu) with $\text{CuK}\alpha$ radiation (40 kV/30 mA) and goniometer rotation of $2^\circ/\text{min}$ and interval of 0.02° , in the range 5° - 35° for natural, purified, and sodium samples, and with a range of 1.5° - 35° for samples with ethylene glycol saturation; thermogravimetric analysis (TG) and differential thermal analysis (DTA, Shimadzu TA 60H system for simultaneous thermal analysis), with a heating rate of $12.5^\circ\text{C}/\text{min}$ in air (the maximum temperature for both cases was 1000°C and the standard used in the DTA was calcinated aluminum oxide (Al_2O_3)).

Na_2CO_3 was added to samples of natural and purified bentonite clays at the ratio of 125 meq/100 g of clay and they were not washed after treatment with sodium carbonate. This concentration was chosen because it gave the best results in [28]. All samples treated with Na_2CO_3 had characteristics determined by XRD and EDX. For this determination, the sodium clays were dried in a kiln at 60°C , disintegrated using a ball mill, and then sieved according to ABNT No. 200 (0.074 mm). Samples of natural clay treated with Na_2CO_3 were named as follow: AM1S, AM2S, AM3S, and AM4S. Clays that were purified and treated with Na_2CO_3 were named: AM1PS, AM2PS, AM3PS, and AM4PS.

The rheological parameters, apparent viscosity (AV) and plastic viscosity (PV), were measured by means of a Fann 35A viscometer, according to the Petrobras standard [29], and calculated using Eqs. A and B:

$$AV = 300 \frac{\theta}{N} \quad (A)$$

where AV is the apparent viscosity given in mPa.s, N is the rotational speed at 600 rpm of the Fann viscometer, and θ is the deflection measured in the viscometer at this speed;

$$PV = 300 \frac{\theta_2 - \theta_1}{N_2 - N_1} \quad (B)$$

where PV is the plastic viscosity given in mPa.s, θ_2 and N_2 were measured at 600 rpm and θ_1 and N_1 at 300 rpm. The filtrate volume (FV) was determined by a filter press test, in which the suspension was inserted and the filtrate collected over a 30 min period after application of a pressure of 690 ± 35 kPa (100 ± 5 psi).

RESULTS AND DISCUSSION

In Table I and Fig. 1 granulometric composition values of the natural and centrifuged clay samples are presented. It can be seen in Table I that the natural samples having the highest percentages of accumulated volume with diameter D smaller than $2 \mu\text{m}$ were AM1 (29.55%) and AM3 (24.71%), corresponding to average particle diameters of 5.89 and $6.10 \mu\text{m}$, respectively. Samples with the greatest percentage of particles with diameter between 2 and $20 \mu\text{m}$ were AM2 (78.18%) and AM4 (73.75%). The samples having the highest percentage with diameter larger than $20 \mu\text{m}$ were AM4 (4.98%) and AM1 (3.75%). These results were similar to those described in [30-33]. Processing the samples in the centrifuge increased the concentration of the portion of clay having $D < 2 \mu\text{m}$ with respect to the natural samples by the following amounts: 228% (AM1), 402% (AM2), 297% (AM3), and 370% (AM4). The mean diameter of particles in the purified samples compared to the natural samples decreased from 6.14 to $0.72 \mu\text{m}$. Analysis of Fig. 1 showed that the samples presented curves with unimodal and bimodal distributions of particle sizes, varying from 0.1 to $12 \mu\text{m}$. With regard to accumulated volume, in D50 the following values were observed: $4.03 \mu\text{m}$ for AM1, $4.55 \mu\text{m}$ for AM2, $4.27 \mu\text{m}$ for AM3, $4.68 \mu\text{m}$ for AM4, $0.6 \mu\text{m}$ for AM1P, $0.58 \mu\text{m}$ for AM2P, $0.9 \mu\text{m}$ for AM3P, and $0.57 \mu\text{m}$ for AM4P. In general, processing by centrifuge led to a reduction of the equivalent mean particle size and an increase in the clay fraction, proving the efficacy of the process, as observed in [21].

In Table II, cation exchange capacity (CEC) values for the natural and centrifuged clay samples are presented, as determined by the methylene blue method. The natural samples had CEC values ranging from 40 to 72 meq/100 g of dry clay, values typically found for bentonite clay from Paraíba, Brazil, using the methylene blue method, consistent with data found in [32-35]. After purification in the centrifuge,

Table I - Granulometric compositions of the natural and centrifuged clay samples.

[Tabela I - Composições granulométricas das argilas naturais e após centrifugação.]

Sample	D<2 μm (%)	2<D<20 μm (%)	D>20 μm (%)	Average diameter (μm)
AM1	29.55	66.70	3.75	5.89
AM1P	97.15	2.85	0.0	0.67
AM2	19.91	78.18	1.92	5.91
AM2P	100.0	0.0	0.0	0.62
AM3	24.71	72.65	2.64	6.10
AM3P	98.14	1.86	0.0	0.98
AM4	21.27	73.75	4.98	6.59
AM4P	100.0	0.0	0.0	0.62

the CEC values increased. This can be seen in Table I, where the purification process raised the concentration of the clay fraction and reduced the mean particle diameter. The best results were achieved with samples AM3 (96 meq/100 g) and AM4 (74 meq/100 g). According to [36], a CEC value above 70 meq/100 g indicates the presence of a high amount of montmorillonite, demonstrating that the centrifugation process was effective.

In Table III, the chemical compositions of the natural and centrifuged clay samples are presented. The results showed a reduction in the concentration of accessory minerals after the treatment by centrifugation when compared to the natural samples, with the greatest reductions found for silica (6.5%, AM3), probably corresponding to free silica, CaO (156%, AM2) corresponding to the presence of calcium carbonate, MgO (10%, AM1), probably corresponding to magnesium carbonate or mica, Fe_2O_3 (67%, AM3), most likely corresponding to goethite and hematite. The values obtained for the chemical composition were similar to those found in [20], again demonstrating the efficiency of the centrifugation process. It was possible to observe, in general, that the clay treatment procedures were effective, as the centrifugation process managed to reduce the fractions of accessory minerals and increase the clay fraction.

Fig. 2 illustrates the results for the X-ray diffraction of the samples under study, treated with ethylene glycol. The curves showed characteristic peaks for smectite (JCPDS 13-0135), quartz (JCPDS 46-1045), kaolinite (JCPDS 78-2110), feldspar (JCPDS 84-0710), and calcite (JCPDS 89-1305). The presence of smectite clay was observed that, with the addition of ethylene glycol, modified the basal interplanar distance from 15.90 to 17.13 \AA for AM1, from 15.3 to 16.23 \AA for AM2, from 15.65 to 16.17 \AA for AM3, and from 15.28 to 16.23 \AA for AM4. All samples showed interlaminate expansion after saturation with ethylene glycol. The displacement of the peak relative to smectite clay confirmed that the samples contained smectite clay minerals [37]. In general, the patterns of the X-ray diffraction confirmed, qualitatively, that the samples had curves typical of bentonite

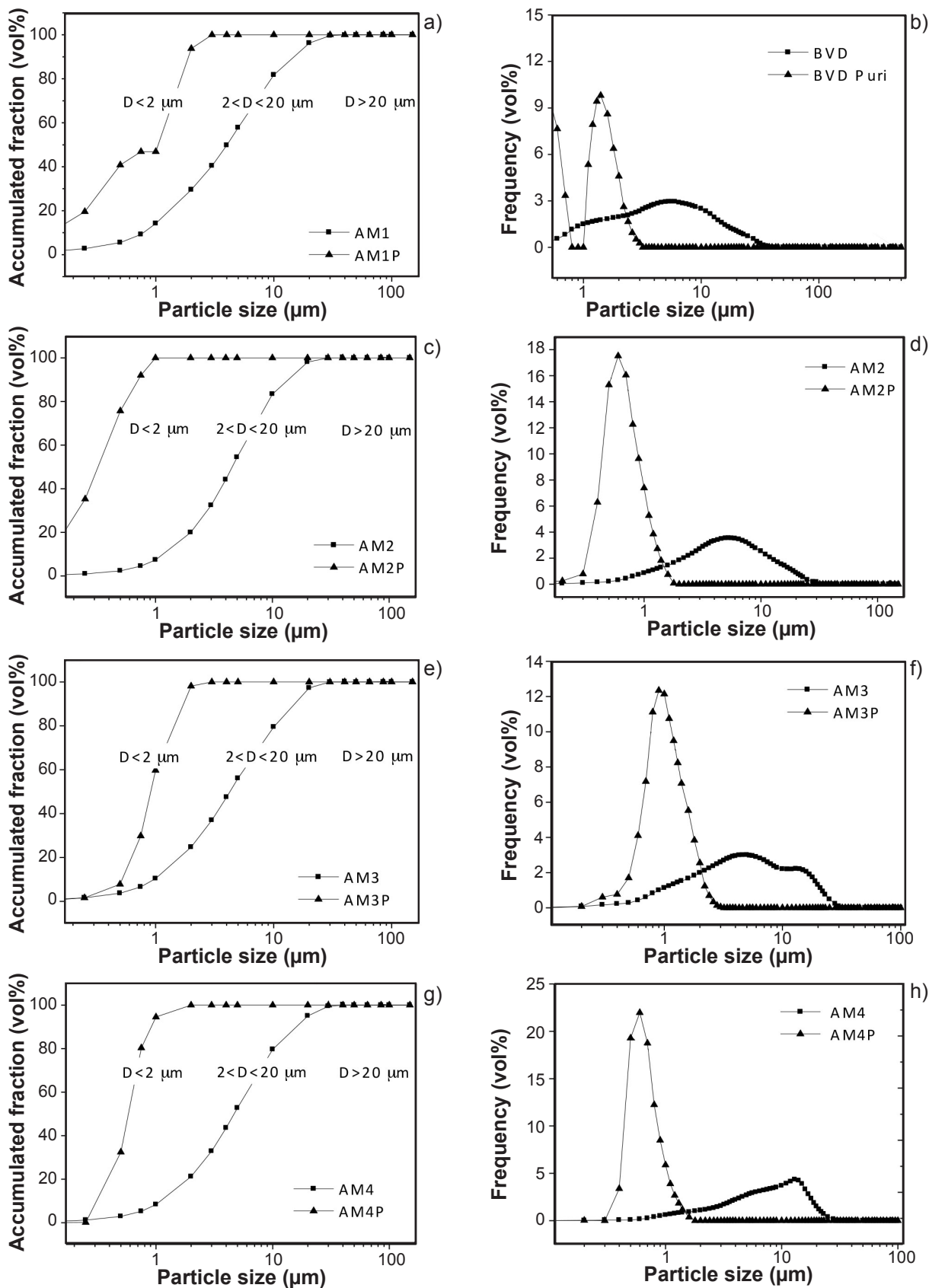


Figure 1: Particle size distribution curves of the samples: (a,b) AM1 and AM1P; (c,d) AM2 and AM2P; (d,e) AM3 and AM3P; (f,g) AM4 and AM4P; shown as accumulated volume (a,c,e,g) and histogram (b,d,f,h).

[Figura 1: Curvas de distribuição granulométrica das amostras: (a,b) AM1 e AM1P; (c,d) AM2 e AM2P; (d,e) AM3 e AM3P; (f,g) AM4 e AM4P; apresentadas em volume acumulado (a,c,e,g) e histograma (b,d,f,h).]

Table II - Cation exchange capacity (meq/100 g) of the natural and centrifuged clay samples.
 [Tabela II - Capacidade de troca de cátions (meq/100 g) das argilas naturais e após centrifugação.]

AM1	AM1P	AM2	AM2P	AM3	AM3P	AM4	AM4P
40	52	52	68	72	96	60	74

Table III - Chemical composition (wt%) of the natural and purified clay samples.
 [Tabela III - Composições químicas (% em massa) das argilas naturais e purificadas.]

Sample	SiO ₂	Al ₂ O ₃	CaO	Na ₂ O	Fe ₂ O ₃	MgO	Other oxides	LOI
AM1	35.9	15.3	9.8	-	7.2	5.4	3.5	22.9
AMS1	34.7	15.0	8.6	5.2	2.7	5.2	3.8	25.8
AM1P	35.3	19.0	6.7	-	6.8	4.9	2.9	24.4
AM1PS	37.9	17.5	5.5	2.8	6.7	4.6	2.6	22.4
AM2	45.2	20.8	2.3	-	6.4	2.9	1.5	20.9
AM2S	43.3	19.8	2.3	3.5	6.0	2.5	1.5	21.1
AM2P	43.9	22.7	0.9	-	6.0	2.8	1.2	22.5
AM2PS	42.7	21.2	0.8	2.9	6.8	2.6	1.0	22.0
AM3	45.8	19.6	2.9	-	2.5	3.1	1.3	24.8
AM3S	45.7	19.2	3.6	3.3	3.4	2.9	0.6	21.3
AM3P	43.0	23.6	1.9	-	1.5	2.9	1.0	26.1
AM3PS	43.6	23.5	1.4	3.0	2.5	3.0	1.3	21.7
AM4	45.9	21.0	1.4	-	6.3	3.1	1.4	20.9
AM4S	43.2	20.3	2.3	3.6	6.3	2.1	1.0	21.2
AM4P	44.5	25.6	0.6	-	5.9	2.3	2.5	18.6
AM4PS	42.6	22.3	0.6	3.0	6.7	2.4	1.4	21.0

Notes: - absent; LOI - loss on ignition.

from Paraíba, Brazil, mostly composed of clay minerals of the smectite group, as observed in [8, 32, 38-40].

Fig. 3 illustrates the X-ray diffraction results of purified, natural, and sodium clays. Analysis of the XRD curves of the natural and purified samples showed an increase in the intensity of the characteristic peaks for smectite for all samples. There was also a larger reduction in the intensity of the characteristic peaks for quartz and kaolinite, indicating that the concentrations of accessory minerals present in the samples after the purification process was reduced, as observed in [12, 15], confirming the granulometric distribution values (Figs. 1a and 1b; Table I). The diffractograms of the clay samples treated with sodium carbonate (Fig. 3) showed a decrease in peak intensity relative to the basal distance of the smectite clay when compared against the natural sample, and a decrease in basal spacing (d_{001}). This may be related to the drying performed after sodium treatment, as the sodium samples were dried at 60 °C for 24 h to allow for sieving. This can be explained because the Na⁺ ion has a coordination number of 12, while Ca²⁺ and Mg²⁺ have coordination numbers of 6. When the sodium clays are subjected to drying at 60 °C, these clays lose water more easily because of the lower binding energy, thus reducing the basal interplanar distance.

Fig. 4 illustrates the thermogravimetric and thermal-

differential curves of the natural and purified clay samples. The DTA curves of the samples under study (Figs. 4a and 4c) show that the samples presented similar thermal behavior, both before and after the purification by centrifugation. For the natural samples, the following thermal transformations were verified: a high endothermic peak around 100 °C, characterizing the presence of free and adsorbed water; an exothermic peak between 150 and 450 °C, corresponding to the combustion of organic matter; an endothermic peak around 580 °C, characterizing the loss of hydroxyls of the clay structure. For samples AM1 and AM3 an endothermic peak at about 701 °C was also observed, possibly related to magnesium carbonate; an endothermic peak with a maximum at 900 °C, characterizing the presence of calcium carbonate; and an exothermic peak with a maximum at 921 °C, characteristic of the nucleation of mullite with the release of α or β -quartz from the amorphous structure previously created. Comparing the thermograms of the present study with those found in previous works [8, 33, 38], a behavior typical of bentonite from Paraíba was observed. The purified clay samples presented the same thermal transformations as the natural ones, with a slight difference in the maximum temperatures of the endothermic bands and of the double peak endo-exothermic, which may be caused by differences in the granulometry of the samples,

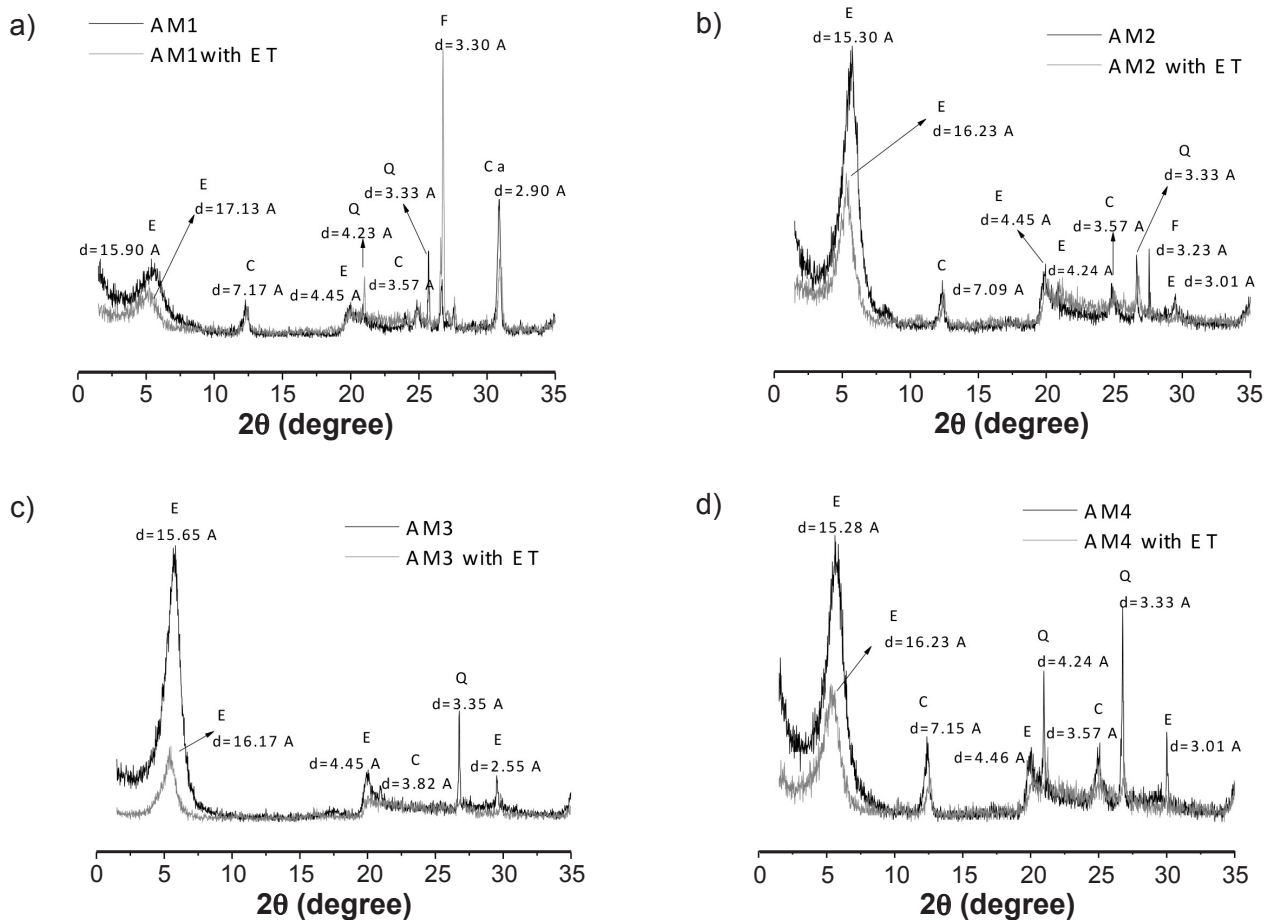


Figure 2: XRD patterns of natural clays treated with ethylene glycol: (a) AM1; (b) AM2; (c) AM3; and (d) AM4. E-smectite; Q-quartz; F-feldspar; C-kaolinite; Ca-calcite; ET-ethylene glycol.
 [Figura 2: Difratogramas de raios X das amostras das argilas naturais tratadas com etileno glicol: (a) AM1; (b) AM2; (c) AM3; e (d) AM4. E-esmectita; Q-quartzo; F-feldspato; C-caulinita; Ca-calcita; ET-etileno glicol.]

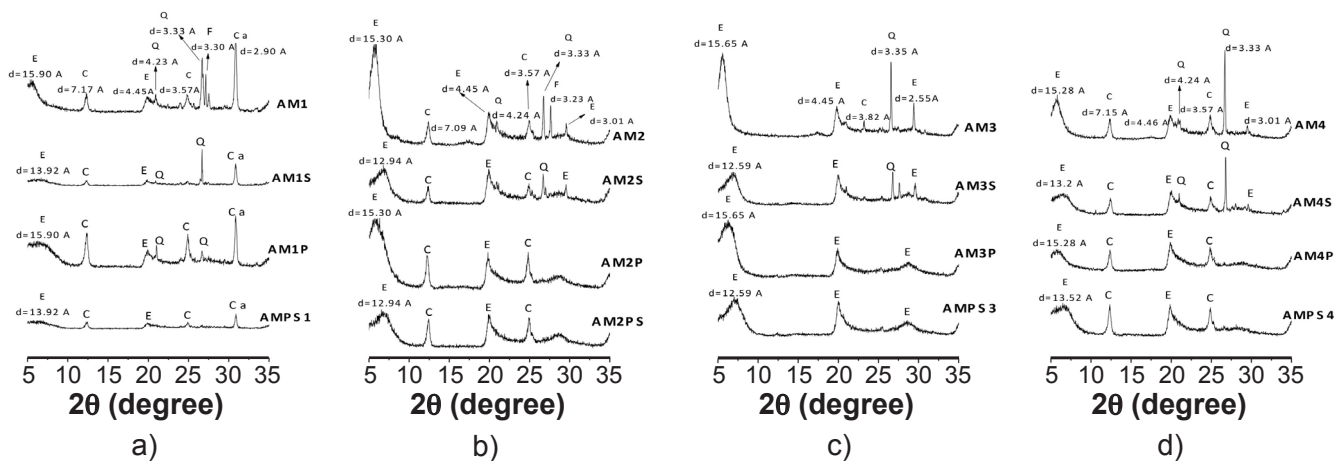


Figure 3: XRD of the natural, purified, and sodium clay samples: (a) AM1, AM1S, AM1P and AM1PS; (b) AM2, AM2S, AM2P and AM2PS; (c) AM3, AM3S, AM3P and AM3PS; and (d) AM4, AM4S, AM4P and AM4PS. E-smectite; Q-quartz; F-feldspar; C-kaolinite; Ca-calcite.
 [Figura 3: DRX das amostras das argilas naturais, purificadas e sódicas: (a) AM1, AM1S, AM1P e AM1PS; (b) AM2, AM2S, AM2P e AM2PS; (c) AM3, AM3S, AM3P e AM3PS; e (d) AM4, AM4S, AM4P e AM4PS. E-esmectita; Q-quartzo; F-feldspato; C-caulinita; Ca-calcita.]

as observed in [12]. Regarding the TG curves of the samples under study (Figs. 4b and 4d), the natural ones experienced a loss of mass varying from 20.96 to 24.84%, whereas the loss of mass for the purified samples was within the range between

18.60 and 26.11%. Samples AM1P, AM2P and AM3P had losses of mass higher than those of their natural counterparts, demonstrating that the purified samples had less quartz and, therefore, a larger fraction of clay than the natural samples.

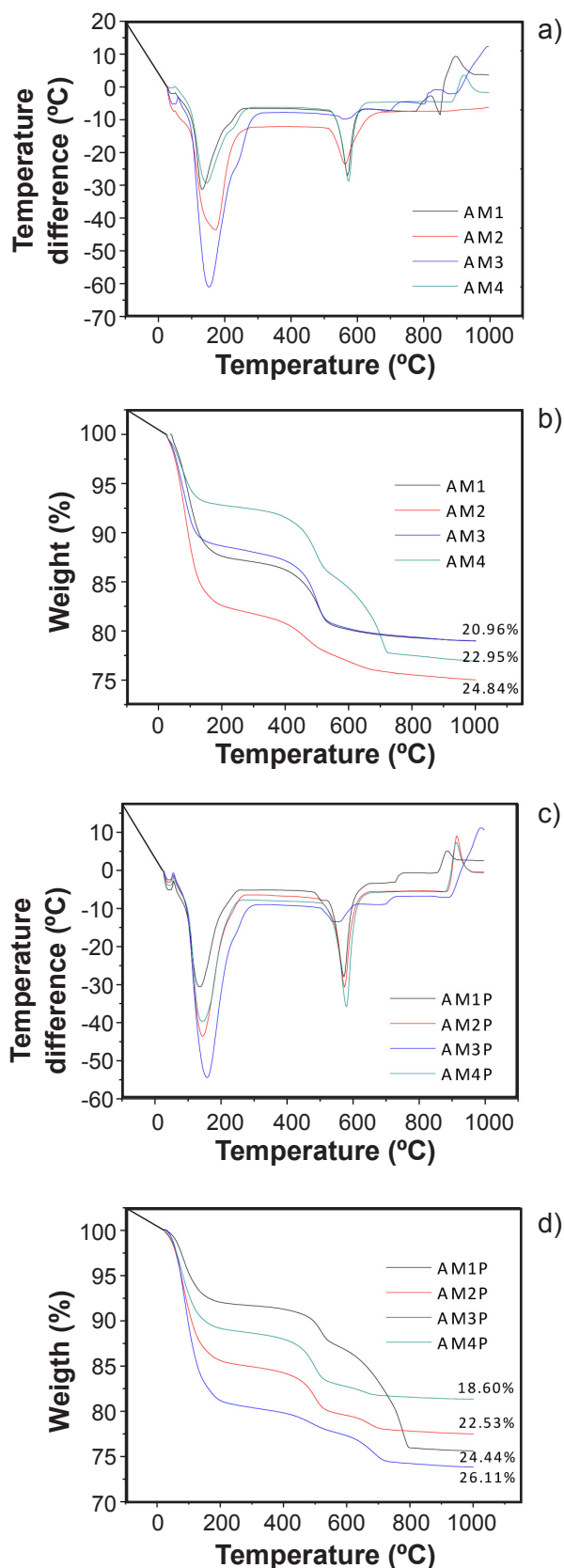


Figure 4: DTA (a,c) and TG (b,d) curves of the clay samples: (a,b) natural samples; and (c,d) purified samples.

[Figura 4: Curvas de DTA (a,c) e TG (b,d) das argilas: (a,b) amostras naturais; e (c,d) amostras purificadas.]

Table IV - Apparent viscosity (AV), plastic viscosity (PV), and filtrate volume (FV) of the natural and centrifuged clay samples.

[Tabela IV - Viscosidade aparente (VA), viscosidade plástica (VP) e volume de filtrado (VF) das argilas naturais e após centrifugação.]

Amostra	Na ₂ CO ₃	VA (cP)	VP (cP)	VF (mL)
AM1	-	1.5	1.0	99.0
AM1	125 meq	13.5	3.0	31.0
AM1P	-	2.5	2.0	74.0
AM1P	125 meq	19.5	4.0	28.0
AM2	-	2.0	1.0	98.0
AM2	125 meq	14.5	3.0	22.5
AM2P	-	3.5	2.0	62.0
AM2P	125 meq	20.5	4.0	18.0
AM3	-	2.0	2.0	87.0
AM3	125 meq	9.5	3.0	33.0
AM3P	-	3.0	2.0	48.0
AM3P	125 meq	19.5	4.0	18.0
AM4	-	1.5	1.0	74.0
AM4	125 meq	7.5	3.0	45.4
AM4P	-	4.4	1.0	71.0
AM4P	125 meq	15.0	5.0	38.0

In Table IV the results of the rheological and filtration properties are shown, apparent viscosity (AV), plastic viscosity (PV), and filtrate volume (FV), of the natural and centrifuged clay samples, with and without the addition of sodium carbonate. The results showed that the samples that were not treated with sodium carbonate did not behave well rheologically, as the polycationic clays have the characteristic to restrict the amount of water adsorbed between particles due to electrical and mass interactions [41]. These samples cannot, therefore, be used in drilling fluid because their rheological properties are inadequate for this application, as observed in [42]. For the clays treated with sodium carbonate (Table IV), significant increases in the values of the rheological properties were observed after the process of purification by centrifuge of 44% (AM1), 41.4% (AM2), 105% (AM3), and 100% (AM4) for apparent viscosity (AV) and increases of 33% (AM1), 33% (AM2), 33% (AM3), and 67% (AM4) for plastic viscosity (PV). The filtrate volume (FV) decreased by 11% (AM1), 25% (AM2), 83% (AM3), and 19% (AM4). These results showed that the process of purification by centrifuge was very efficient for enhancing the rheological properties of the samples in aqueous suspensions.

It was observed from the characterization analyzes (Figs. 2 and 3; Table III) that with the centrifugal purification process an increase of the clay fraction occurred, and a decrease in the fractions of the accessory minerals, causing improvement in the rheological properties and filtration.

According to [43], drilling fluids change their rheological behavior in the presence of contaminants, with plastic and apparent viscosities and filtrate volume being the properties most affected. It is important to note that, even in small amounts, carbonates and hydroxides can strongly influence the colloidal concentrations and rheological properties of clay suspensions. Regarding the rheological properties, it was found that all suspensions prepared with purified clay had viscosity values above the minimum requirements of the Petrobras standards [29] for drilling fluids ($AV \geq 15.0$ cP and $PV \geq 4.0$ cP). However, it must be highlighted that, although the values of FV were reduced for all clay suspensions following treatment, the results obtained for samples AM2P and AM3P were the only ones that met the minimum requirements of the Petrobras standards [29] for drilling fluids ($FV \leq 18.0$ mL). As observed in [38, 44-45], the best rheological properties were found in samples with smaller mean diameters and higher content of particles with size below $2 \mu\text{m}$. Analysis of all results with regard to rheological properties revealed that the purified samples were the most suitable for technological applications, especially for use in drilling fluids.

CONCLUSIONS

After analyzing the influence of the purification by centrifugation of bentonite clays from new deposits in Paraíba, Brazil, on their potential use in water-based drilling fluids, it was possible to conclude that the centrifugal treatment process was effective for reducing the concentration of accessory minerals, reducing the mean equivalent particle size, and increasing the fraction of clay. It was also observed that the dispersions prepared from the clays purified by centrifugation and mixed with 125 meq/100 g of dry clay showed improvements in rheological and filtration properties, making them adequate for use in the drilling of oil wells.

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