Western European Journal of Modern Experiments and Scientific Methods
Volume 2, Issue 6, June, 2024
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

INVESTIGATION OF THE PHYSICO-CHEMICAL PROPERTIES AND COMPOSITION OF SURKHONDARYA LIMESTONE AND CLAY SOILS NECESSARY FOR THE PRODUCTION OF PORTLAND CEMENT

Ramazanov Salohiddin
PhD student,
Tashkent chemical-technological institute, 100011,
Republic of Uzbekistan, Tashkent, st. Navoi 32
Aripova Mastura
Doctor of Engineeringtechnical sciences, professor,
Tashkent chemical-technological institute, 100011,
Republic of Uzbekistan, Tashkent, st. Navoi 32

Abstract

This article predicts the study of the physico-chemical properties of the composition necessary for the production of Portland cement based on the Surkhondarya region of Boisun limestone and clay. The structure and properties of the resulting composition were studied by IR spectroscopy and X-ray diffractometry.

Key words: **cement, clinker, clay, limestone, Portland cement, IR spectroscopy, X-ray diffractometry.**

Introduction

In order to further improve the construction industry, form mechanisms for the consistent development of bodies and institutions of architecture and construction, ensure the efficiency of the public administration system, and progressively introduce digital technologies into the field, the President approved the Strategy for Modernization, Accelerated and Innovative Development of the Construction Industry by Decree of the President [1].

In order to create favorable conditions for the accelerated development and diversification of the industry, attract investment in the processing of local mineral raw materials and increase the export of building materials, the government approved the forecast parameters for expanding the raw material base of the construction industry. Based on the exploration, extraction and processing of local raw materials in 2019-2025 and the target parameters for the production of building materials in 2019-2025, taking into account the diversification and expansion of the product range, it is planned to increase the production of wallpaper by more than 47 times, aerated concrete blocks - 7 times, paint and varnish materials - 4 times, composite reinforcement from basalt - 3 times and cement - 2 times [2].

The achieved level of cement production of about 9,000 thousand tons per year (as of 2018) is not able to meet the needs of the market. As presented in Table 1, the volume of construction work is growing every year, over 20 years from 388 billion soums in 2000 to 65154.6 billion soums in 2020, which indicates a significant economic growth of the industry [3]. In our republic, a lot of work is being done to provide technologies for the production of

Western European Journal of Modern Experiments and Scientific Methods
Volume 2, Issue 6, June, 2024
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

Portland cement on a raw material basis and the production of cost-effective clinker compositions [4].

The properties of oxides in Portland cement appear. Basic oxides CaO, SiO_2, Al_2O_3, Fe_2O_3 ensure the formation of minerals

EXPERIMENTAL PART

To study the composition and structure of the constituent parts of the isolated solid samples, IR spectra and X-ray phase spectra were taken and analyzed. Samples were identified on the basis of diffraction patterns, which were recorded on a computer-controlled XRD-6100 (Shimadzu, Japan) apparatus. IR spectroscopic analysis was determined on an infrared spectrometer "IRAffinity-1S" Fure (Shimadzu, Japan), wavelengths of the spectral range 4000÷400 cm^{-1}, signal-to-noise ratio - 60,000:1, scanning speed 20 spectra per second [5-7].

RESULTS AND DISCUSSION

We have studied the physico-chemical properties and composition necessary for the production of Portland cement based on local blue resources - the example of Surkhondarya limestone and clayey soils.

The IR spectra of Baysun limestone are almost identical to other measured IR spectra of limestones from Uzbekistan, but their intensity is slightly different. In addition, slight changes in intensity values are observed. In the range from 2516 to 3687.93 cm^{-1}, vibrations are observed with the participation of the hydroxyl group. Vibrations of the triple bond are observed in the region of 2140.52 cm^{-1}, and vibrations of the secondary bond are observed in the region from 1798.64 to 1030 cm^{-1}. At 877.17 and 475.94 cm^{-1}, bending vibrations of oxygen and carbon atoms are observed, corresponding to the upper range of IR radiation.

In addition, in the IR spectra of Baysun limestone, S-O stretching vibrations are observed in the region of 1489.06 cm^{-1}, Si-O in the region of 1030 cm-1, O-S-O in the region of 676.17 cm^{-1}, SiO valence vibrations are observed in the region of 711, 74 cm^{-1}, and the stretching vibrations of calcium oxide CaO are in the region of 475.94 cm^{-1} [6, 7] (Fig. 1.).

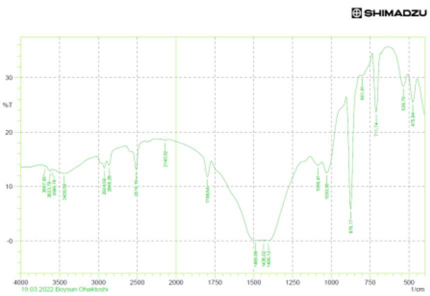

Fig.1. IR spectrum of Baysun limestone

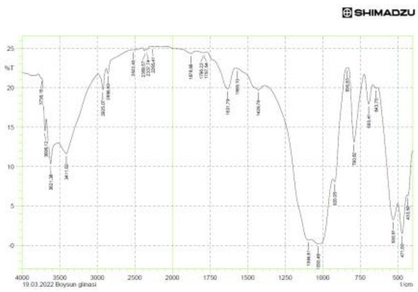

Fig.2. IR spectrum of Baysun clay

For Baysun clay, vibrations involving hydrogen atoms are observed in the range from 3736.15 to 2856.6 cm^{-1} and have different intensities, triple bond vibrations in the range from 2522.43 to 1796.22 cm^{-1}, secondary bond vibrations are observed in range from 1787.54 to 1428.78 cm^{-1}, and bending vibrations of oxygen and carbon atoms - in the upper region of IR radiation from 920.05 to 433.5 cm^{-1}. In addition, in the IR spectra of Baysun clay, the following are observed: a stretching molecular vibration in the region of 3411.62 cm^{-1}, a stretching molecular vibration of Si=O in the region of 1094.61 cm^{-1}, and a deformation molecular vibration for a water molecule in the region of 693.41 cm^{-1}. Stretching molecular vibrations of aluminum oxide are observed in the region of 433.50 cm^{-1} [7,11] (Fig.2.).

Western European Journal of Modern Experiments and Scientific Methods
Volume 2, Issue 6, June, 2024
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

We also studied the compositional and structural properties of Baysun limestone and clay by X-ray diffractometry (X-ray phase analysis). Sample identification was carried out in the laboratory of the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan (Fig. 3-4.).

The Surkhandarya valley is an area of extremely southern location in Uzbekistan; it includes all the main types of landscape inherent in Uzbekistan - from desert plains to mountainous areas. The territory under consideration is characterized, on the one hand, by the complexity of the geological structure, the formation of the relief, on the other hand, by the diversity of soils, peculiar parent rocks, the variety of hydrothermal and climatic conditions (especially arid ones), which leads to the development of sparse vegetation and low soil biogenicity; all this leads to degradation processes (such as erosion, salinization, etc.).

A characteristic feature of the studied desert soils is stratification and a sharp change in the mechanical composition as the soil stratifies. In some places, clayey loams alternate with sandy loam, and sandy soils with clays; a sharp change in the content of mechanical fractions is associated with a sharp and more contrasting change in the lithology of the alluvial deposits [9]. For this purpose, we studied the compositional structures of the Baysun limestone and clay, as well as their need for the production of Portland cement.

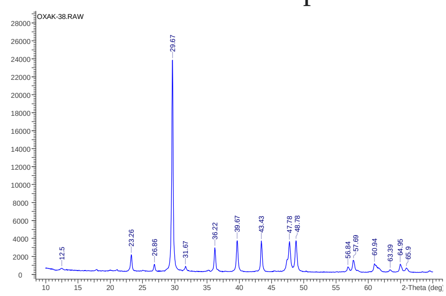

Fig.3. Diffractogram of Baysun limestone

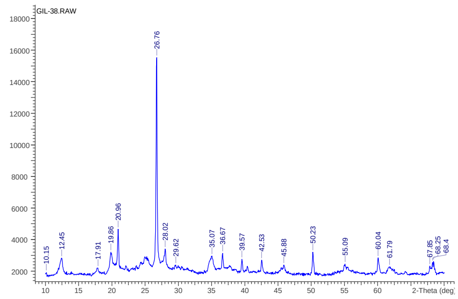

Fig.4. Diffraction pattern of Baysun clay

When interpreting the diffraction patterns, the composition of the samples was determined using the Crystal impact software package.

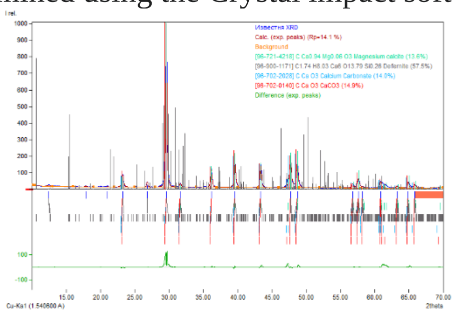

Fig.5. Deciphered diffraction pattern of Baysun limestone

Fig.6. Deciphered diffraction pattern of Baysun clay

After deciphering the samples of Baysun limestone and clay, data were obtained on the composition of oxides (Table 1) and a comparative diffraction pattern based on the Crystal impact software package [8] (Fig.5-6.). For example, the crystal cell of the Baysun limestone is 13.6% identical to magnesium calcite, 57.5% identical to the defernite mineral, 14.0% identical to an equal density of 2.705 g / cm^3 of calcium carbonate and 14.9% identical to a density of 2.718 g / cm^3 of calcium carbonate [6]. And also, when deciphering the diffraction pattern of Baysun clay, the relative crystalline parameters were determined to be 44.3% on quartz, 43.9% on muscovite and 11.8% on kuselite [10]. With the help of the program, the degree of crystallinity and the amorphous content (wt.%) for limestone were also determined to be 49.18% and 50.82%; for clay equal to 13.25% and 86.75%.

Table 1

The composition of the oxides of Baysun limestone and clay

№	*Name*	*SiO_2*	*Al_2O_3*	*MgO*	*CaO*	*SO_3*	*R_2O*	*RFP*	*Others*	*Sum*
1	*Baysun limestone*	*4,1%*	*1.8%*	*0,8%*	*52,99%*	*0.22%*	*0,31%*	*40,4%*	*0,27 %*	*100 %*
2	*Baysun clay*	*57,1%*	*18,1%*	*1,8%*	*4,2%*	*0,21%*	*2.4%*	*9,04%*	*1,85%*	*100%*

CONCLUSION

Concluding the above-mentioned data, it can be concluded that the studied two local raw materials are suitable for the production and production of Portland cement in terms of composition. But using these substances, we will not be able to get Portland cement, in order for us to study the characteristics of the remaining ingredients (from local and secondary resources) and technological parameters, this will be our next message.

REFERENCES

1. Указ Президента Республики Узбекистан УП-6119 от 27.11.2020 г. «Об утверждении Стратегии модернизации, ускоренного и инновационного развития строительной отрасли Республики Узбекистан на 2021 -2025 годы». 2. Постановление Президента Республики Узбекистана ПП-4335 23.05.2019 «О дополнительных мерах по ускоренному развитию промышленности строительных материалов».
3. Хаирова Д.Р., Сайфуллаева М.И. Тенденции развития цементной индустрии в Узбекистане //Бюллетень науки и практики. – 2021. – Т. 7. – №. 6. – С. 358-362.
4. Xikmatovna, Aripova Mastura, Shamatov Sirojiddin Abdujalilo'g'li, and Shaxzoda Nodirjonqizi O'razboyeva. "History of powder metallurgy development." International Journal of Philosophical Studies and Social Sciences (2022): 25-27.
5. Хожиев Ш.Т., Косимов И.О., Гаибназаров Б.Б. Задачи решаемые с помощью порошковой дифрактометрии. **Сборник материалов** II **международной научно-теоретической конференции** «**Актуальные вопросы естественных наук**» 19 **мая**, 2021 **г.Часть** II.С. 159.
6. Falini G. et al. Structure and morphology of synthetic magnesium calcite //Journal of Materials Chemistry. – 1998. – Т. 8. – №. 4. – С. 1061-1065.
7. Trezza M. A., Lavat A. E. Analysis of the system $3CaO\cdot Al_2O_3–CaSO_4\cdot 2H_2O–CaCO_3–H_2O$ by FT-IR spectroscopy //Cement and Concrete Research. – 2001. – Т. 31. – №. 6. – С. 869-872.
8. Putz H. et al. Match!-phase identification from powder diffraction, crystal impact //Bonn, Germany. – 2003. – С. 102.
9. Akramovna G. L., Abdukarimovna K. D. Complex genetic research of soils of Surkhandarya valley with microbiological and biochemical study // European science review. – 2018. – №. 5-6. – С. 258-260.

ISSN (E): 2942-1896 Open Access| Peer Reviewed

10. Ikuta D. et al. First in situ X-ray identification of coesite and retrograde quartz on a glass thin section of an ultrahigh-pressure metamorphic rock and their crystal structure details //American Mineralogist. – 2007. – Т. 92. – №. 1. – С. 57-63.
11. Ганиев Б.Ш., Икромов У.Г., Авезов К.Г., Мардонов У.М., Хожиев Ш.Т., Косимов И.О. Изучение составно-структурных особенностей продуктов кислотной переработки глины месторожднения «Азкамар». V-Международная конференция-симпозиум…Ташкент. – ООО “Innovative Chemical Technologies”. – 2021 г. 25 ноябрь. – С. 238-240