Used materials

According to the findings, the main CO_2 absorption process is provided by the converter's first battery, which has a fractional composition of $Ca(OH)_2$ at 94.5% and NaOH at 6.5%. The second battery fractional composition is Na_2O (8%), KOH activators, and a filter in the form of natural clay powder. The third battery contains zeolite SiO_2 (24%) with Al_2O_3 (1%), Fe_2O_3 (4%), and CaO (30%) with a 40% mass of volcanic slag for absorbing dry materials from exhaust gases.

The absorption process mainly occurs in the first battery of the converter based on the molecular network effect, according to the following chemical reaction:

$$Ca(OH)_2 + CO_2 = CaCO_3\downarrow + H_2O.$$

The absorption process proceeds through the medium of activators in the converter's second and third batteries in accordance with the following chemical reactions:

$$CaO + CO_2 = CaCO_3,\ KOH + CO_2 = KHCO_3.$$

Zeolite, dry clay powder, and volcanic slag were used as absorbent mineral materials. The total cost of the used materials is 3-5$.

Discussion of CO_2 gas neutralization test results

Neutralization of CO_2 is because of the chemical reactions occurring in the converter, in which activators, volcanic slag and dry powdered clay are present.

The peculiarity of CO_2 neutralization among the existing methods is the absorption process, which occurs in the medium of mineral dry materials and is the only acceptable method for automobiles.

The study's limitation is the need to change periodically the converter's absorbent batteries.

The disadvantage of the study is the need for three different batteries in the converter, which can be eliminated by combining them into one common mass.

The further development of the study is to develop high-efficiency and productivity absorbents, which requires long-term experimental studies.

Conclusion

1. With the proper structural modifications (adjustments), the developed technology and converter for the neutralization of greenhouse gases and CO2 emitted from the automobile exhaust system can be installed in the automobile pipeline for exhaust gas removal and provide CO2 reduction of up to 92%, according to the analysis of the conducted scientific results.
2. For calculating the CO2 neutralization converter capacity and productivity, it is necessary to solve a simple analytical problem regarding the dependence of the ratio of the engine's working volume and the active surface of the converter.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

Financing

The study was performed without financial support.

References

[1]. M. Clairotte, R. Suarez-Bertoa, A.A. Zardini, B. Giechaskiel, J. Pavlovic, V. Valverde, B. Ciuffo, C. Astorga, Exhaust emission factors of greenhouse gases (GHGs) from European road vehicles. Environmental Sciences Europe, 32 (1), 2020. Doi: https://doi.org/10.1186/s12302-020-00407-5

[2]. I.I. Mazur, O.I. Moldovanov, V.N. Shishov, Inzhenernaya ekologiya: Teoreticheskiye osnovy inzhenernoy ekologii. Vysshaya shkola, Moscow, 1996 (in Russian).

[3]. P. Crist, Transport Infrastructure and Network Adaptation to Climate Change: Issues and Strategies for Ports. UNCTAD AdHoc Expert Meeting on Climate Change Impacts and Adaptation: A Challenge for Global Ports, Geneva, September 29-30, 2011.
[4]. M.V. Vishnetskaya, M.S. Ivanova, M.YA. Mel'nikov, Prevrashcheniya CO2 v dvukhfaznykh sistemakh C8F18-H2O i C6F6-H2O. Bulletin of Moscow University, 59 (5), 387-392, 2018 (in Russian).
[5]. V.N. Lukanin, Y.V. Trofimenko, Promyshlenno-Transportnaya Ekologiya. Vysshaya shkola, Moscow, 2003 (in Russian).
[6]. K. Mosikyan, M. Barsegyan, M. Papinyan, Konvertor dlya neytralizatsii parnikovykh gazov avtomobil'nykh benzinovykh dvigateley. Eurasian Union Scientists, 5, 12 (81), 12-16, 2020. (in Russian). Doi: https://doi.org/10.31618/ESU.2413-9335.2020.5.81.1167
[7]. G.N. Alekseyev, Obshchaya teplotekhnika. Vysshaya shkola, Moscow, 1980 (in Russian).
[8]. S.V. Tkachev, V.V. Khrustalev, Obshchaya khimiya. Vysshaya shkola, Minsk, 2020 (in Russian).
[9]. A.K. Cheetham, P. Day. Solid State Chemistry, Oxford University Press, 1992.
[10]. A.I. Ryabchinskiy, Y.V. Trofimenko, S.V. Shekmakov, Ekologicheskaya bezopasnost' avtomobilya. Moscow Automobile and Road Construction State Technical University, 2000 (in Russian).
[11]. J.L. Talib, M.A. Salih, Development of Diesel-Oxygenated Blends and Exhaust Gas Recirculation Impact on Diesel Engine’s Performance and Emission. Eastern-European Journal of Enterprise Technologies, 5, 10 (119), 32-38, 2022. Doi: https://doi.org/10.15587/1729-4061.2022.265764
[12]. W.L. Anggayasti, N.W. Satrio, I.N.G. Wardana, A. Kurniawan, The mechanism of pH recalibration by dissolved oxygen in alkaline modified aquaculture seawater. Eastern-European Journal of Enterprise Technologies, 5, 10 (119), 6-13, 2022.
Doi: https://doi.org/10.15587/1729-4061.2022.266012
[13]. K. Eisenack, R. Stecker, D. Reckien, E. Haffmann, Adaptation to Climate Change in the Transport Sector: A Review of Actions and Actors. Mitigation and Adaptation Strategies for Global Change, 17, 451-469, 2012. Doi: https://doi.org/10.1007/s11027-011-9336-4
[14]. E. Hooper, L. Chapman, The Impacts of Climate Change on National Road and Rail Networks, in: T.Ryley, L.Chapman (eds.), Transport and Climate Change. Emerald Group Publishing Ltd, 2, 105-136, 2012. Doi: https://doi.org/10.1108/S2044-9941(2012)0000002008
[15]. Y. Vardanyan, V. Harutyunyan, K. Mosikyan, V.Koichev, The Basics of Developing an Alternative Concept for Commercial and Military Vehicle Operation (Random Strategy). Journal of Architectural and Engineering Research, 1 (2), 62-69, 2021. Doi: https://doi.org/10.54338/27382656-2021.2-4

Yeghiazar Vardanyan, Doctor of Science (Engineering) *(RA, Yerevan) - National University of Architecture and Construction of Armenia, Professor at the Chair of Construction Machinery and Organization of Traffic, yeghiazar.vardanyan@gmail.com*

Valerik Harutyunyan, Doctor of Philosophy (PhD) in Engineering *(RA, Yerevan) - National University of Architecture and Construction of Armenia, Associate Professor at the Chair of Construction Machinery and Organization of Traffic, vmh-1961@mail.ru*

Vladimir Sahidovich Koichev, Doctor of Philosophy (PhD) in Engineering *(RF, Kaliningrad) - Baltic Fishing Fleet State Academy, Associate Professor at the Chair of Motor Transport and Car Service, bugakova@bga.gazinter.net*

Karapet Mosikyan, Doctor of Philosophy (PhD) in Engineering *(RA, Yerevan) - National University of Architecture and Construction of Armenia, Associate Professor at the Chair of Construction Machinery and Organization of Traffic, karomosikyan@mail.ru*