ABSTRACT

Sustainable advanced roads that absorb tonnes of CO_2 annually and become more resistant using Olivine

Sara Bayandor

Keywords: Sustainable, Roads, Olivine, Soil Stabilisation, CO_2

Greenhouse gases, which mostly come from burning fossil fuels, are accumulating every day in the atmosphere and changing the climate around the world. New Zealand's average annual temperature has risen by 1.13 degrees Celsius from 1909 to 2019 [1]. As a result, the level of sea is rising and adverse changes such as extreme rainfall, drought, increasing hunger and poor nutrition are beginning to emerge. Statistics show that the transport sector produces a considerable amount of carbon dioxide (CO_2) annually. In New Zealand, road transport made up 43% of gross CO_2 emission in 2018 and improving the engine technology was not effective [1]. Olivine is an easily accessible mineral that is found all over the earth's mantle. Under natural conditions, 1 kg of Olivine can absorb about 1 kg of CO_2 [2]. For optimal absorption, Olivine stone needs to be pulverised. Magnesium silicate in the stone reacts with water and CO_2 to form bicarbonate that captures CO_2 in a solid form. In addition to taking up CO_2, Olivine has the potential to stabilise the soil sustainably through alkaline activation. New Zealand has 83,000 km of local roads and 11,000 km of state highways that have the potential to sequester CO_2 not only in roads but also in the roadside area. Initial calculations show that the unsealed roads of New Zealand have the potential to absorb about 100,000 tonnes of CO_2 annually. This study is a review paper that summarizes the recent progress in the field of sustainable roads. This presentation aims to evaluate the feasibility of using Olivine in road construction to stabilise the soil and calculate the potential of CO_2 absorption in New Zealand to take a step toward the Climate Change Response (Zero-Carbon) Amendment Act 2019 and considerations concerning kaitiakitanga (guardianship).

References

Ministry for the Environment & Stats NZ (2020). New Zealand's Environmental Reporting Series: Our atmosphere and climate 2020. Available from www.mfe.govt.nz and www.stats.govt.nz

Bakker, D. J., V. Beumer, N. Hartog, W. J. M. Snijders, M. S. Sule, J. P. M. Vink (ed.), (2010). Toepassing van olivijn in RWS-werken. Inventarisatie van mogelijkheden voor een pilot. Deltares rapport 1203661-000-VEB-0006, Utrecht