1. **Project Title:** Synergistic Utilization of Aluminium Industrial Wastes for Development of Geopolymeric Building Materials (S-21).

   **File No:** 14/34/2015-Met.IV

2. **Objective:**
   - To develop marketable building materials such as brick, block and tiles from geopolymerized raw material combinations.
   - To study the environmental impact of geopolymerized building materials.
   - To explore the scope of value addition of the products with respect to market and demand based on the input from entrepreneur.
   - To carry out the mini pilot plant trial for verifying scope for commercialization.

3. **Background:**

   In the recent past JNARDDC has developed simple and cost-effective process for management of major solid wastes generated at the aluminium industry. Subsequently the R&D efforts were focused on the development of viable products that consume bulk volumes of different solid rejects. Since the infrastructural development across the land is booming with great potential of consuming large volumes of solid rejects, the above R&D work was undertaken for development of economically viable products.

   A wide variety of solid rejects viz., fly ash, red mud and other mining rejects such as saprolite, lateritic overburden, partially lateritic khondalite (PLK) and kaolinitic khondalite (KK) etc. were used for making geopolymer based building materials. Other locally available waste materials such as variety of clays, ash, effluents, sediments as well as major solid wastes from other industries (steel, power, oil, and biomass) were also found useful for making green building materials.

   Exploitation of by-product synergy is a growing practice worldwide. It consists in the maximization of resources utilization with the replacement of natural or costly raw materials by by-products as inputs for industrial processes. Successful utilization of rejects is the best option for resource augmentation and management especially with the participation of an industry partner.

4. **Outcome:**
   - The concept of synergistic utilization of these materials has been successfully achieved for generation of quality building products suitable for urban and rural
Building application. The present study verified impact of atmospheric moisture, effect of soda content and efflorescence, improvement of crushing strength and value addition of product based on physical modification.

**Developed the following products:**

a) Hard geopolymer bricks (non-fired, crushing strength ranging 5-15 MPa)
b) Light weight geopolymer bricks (non-fired, crushing strength ranging 5-10 MPa)
c) Hard fibre reinforced geopolymer blocks/bricks (non-fired, crushing strength ranging 30-45 MPa)
d) Hard high strength paver blocks ((non-fired, crushing strength ranging 30-42 MPa)
e) Light weight foamed geopolymer bricks (non-fired, crushing strength ranging 5-8 MPa)
f) Light weight foamed and layered geopolymer bricks (non-fired, crushing strength ranging 5-8 MPa)
g) Sandwich type geopolymer (multi layered, non-fired, crushing strength ranging 4-8 MPa)

- **Mini pilot plant studies and cost estimation of geopolymer products were carried out successfully in collaboration with Entrepreneur (M/s. Swarnalatha Holding, Raipur, Chhattisgarh) Capacity 300 bricks per cycle (4 cycles per 8 h)**

- **The process is ready for the next level production viz setting up of a pilot plant by the Entrepreneur for commercializing the technology after working out the techno-economics.**

5. **Research Publication**


3. Effect of Molar Concentration of Alkali Activators on Strength of Geopolymeric Bricks; Shama Wadsariya, Vishakha V Sakhare, Numanuddin Azad, **Mohamed Najar P A**, Mukesh Chaddha, Kiran Janbandhu, P G Bhukte, S P Puttewar and Anupam Agnihotri, National Seminar on Geopolymer an Innovative Technology
Brief write-up on S&T (Mines) completed projects

in Civil Engineering Materials (GITCE), University, Bangalore, February 24-25, 2017.


Brief write-up on S&T (Mines) completed projects

6. **Patent Filed:**
   - A light weight foamed geopolymer (LWFGEOG) and it's preparation, vide No. 201621038525, dt 10.11.2017.

7. **Product Exhibitions:**
   - Green Ashcon 2017, Nagpur
   - Raman Science Centre, Nagpur 2018 & 2019

8. **Academic outcomes:**

   **M Tech:** 1
   Use of Industrial Rejects / By-products for development of Geopolymer Building bricks, KDK College Nagpur

   **UG Projects (BE):** 2
   VNIT Nagpur

   **PG Projects:** 2
   Hislop College, Nagpur

9. **Conference Organised:**

   - A national seminar “**Geopolymer based Innovative Technologies in Civil Engineering Materials**” organized at Christ University, at Bangalore Campus during 23-24th February 2017. Three research papers presented based on the project (research) work.

10. **Invited Lecture**

    - Aluminium Industrial Rejects: A Potential Resource for Development of Geopolymeric Building Materials