









- 2- A similar finding of those specimens with BIO and specimens with BS was also observed with the addition of TiO.
- 3- A significant increase in slump was measured in concrete specimens with PAA. An average of 24% increase in slump with every percent increase in PAA was obtained.
- 4- There was an also increase of 6.4 % and 3.4 % in the 7 days compressive strength of concrete at every 0.5 % increase in specimens with BIO and specimens with BS respectively.
- 5- The addition of 1 % TiO and 1 % PAA by cement weight to concrete gave 18.5 % and 6.3 % improvement in the 7 days compressive strength, respectively. This gain in strength started to decrease beyond the 1 % TiO and 1 % PAA with a decreasing rate of 1.34 % and 0.7 % respectively at every 1% increment of these NM.
- 6- An improvement of 6.9 % and 3.0 % in the 28 days strength was measured at every percent increase of BIO and BS to the concrete, respectively. The total improvement obtained in the 28 days strength at 2.5 % of BIO and 2.5 % BS by cement weight was 34.3 % and 15.2 %, respectively.
- 7- The maximum strength of 3.6 % and 16 % for the PAA specimens and TiO specimens was obtained at 1% content of each of them, respectively. Beyond this 1 % content of PAA and TiO, there was a loss in the gained strength.
- 8- The addition of 5 % PAA to the 2.5 BIO specimens increased the slump from 90 mm to 170 mm (88.9 % increase) and improved the 28 days compressive strength from 37.37 kg/cm<sup>2</sup> to 49.35 kg/cm<sup>2</sup> (32.1 % increase).
- 9- By adding 5 % PAA to the 1 % TiO specimens, the slump increased from 90 mm to 145 mm (61.1 % increase) and the 28 days compressive strength improved from 37.37 kg/cm<sup>2</sup> to 44.12 kg/cm<sup>2</sup> (18.1 % increase).
- 10- Adding 5 % PAA to the 2.5 % BS specimens gave an increase in slump from 108 mm (for BS alone) to 150 mm with 5 % PAA and 2.5 % BS together. Also, a slight enhancement of 8.1 % was obtained in the 28 days compressive strength.

## VI. ACKNOWLEDGMENT

The authors would like to express their thanks and appreciation to all technical staff at the Materials and Soil Lab. At the Islamic University of Gaza, The Gaza Strip, Palestine for their continuous support during the course of preparation of the current study.

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