$0.3708T+12.9488 = 0$ (25)

where T = 14.57, (4.3) gives 18.35 > 0

Hence to minimize excessive loss of TEG at Imo River AGG plant, temperature should be kept at a value of 30^oC or lower than the operating temperature of 40^0C.

3.5.2 Determination of Optimum Pressure that will give the Least TEG Loss

Regress analysis was used to fit a curve showing the relationship between TEG loss and pressure from the graph in figure 5, the equation of the curve was determined to be

$$y = 9E-8\,x^3 - 0.0017x^2 + 10.611x + 22408 \quad (26)$$

Where y = TEG loss in kg/hr

X = Pressure in kpa

Rewriting the equation as

$$L = 9E-8\,P^3 - 0.0017P^2 + 10.611P + 22408 \quad (27)$$

Equation 4.5 was differentiated and equated to zero as shown in (4.6)

$0.00000027P^2 – 0.034P + 10611 = 0$ (28)

Solving (28) as a quadratic equation gives two values P_1 = 3202kpa and P_2 = 122,734kpa , but to find the minimum value of P we differentiate (27) a second time to give (29) and substitute the value of P_1 to see if it gives a positive value then we can conclude that this value gives the minimum operating Pressure.

$0.00000054P – 0.034 = 0$ (29)

Where P = 3202kpa, (4.7) gives -0.0322 < 0

The maximum pressure at which the plant should operate is 3202kpa but the operating pressure of the plant is 6800kpa which should be reduced to minimize excessive loss of TEG.

Substituting the value of the optimum pressure (3202Kpa) into equation (29) to find the corresponding TEG LOSS gave a loss of 4.19%.

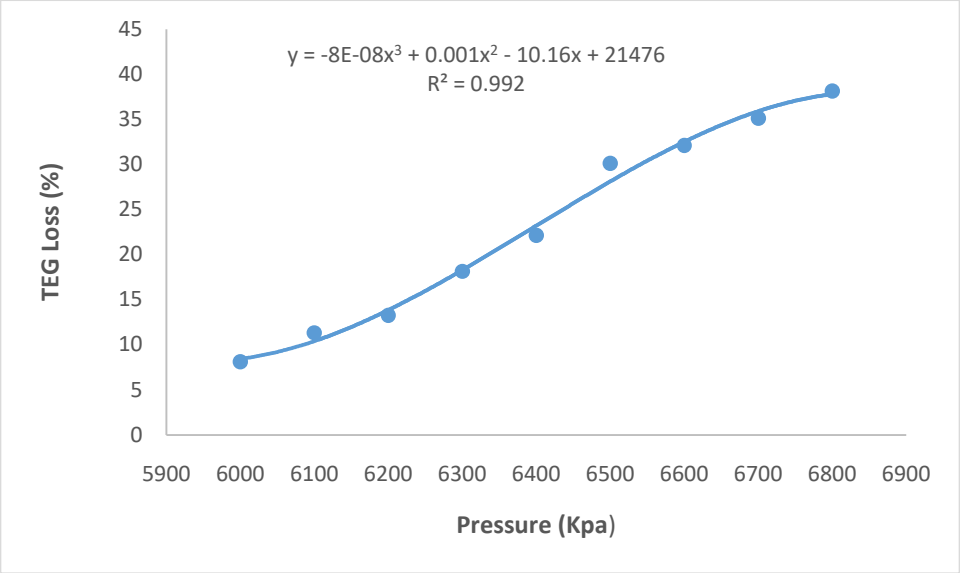

Figure 5: Regression Equation of TEG Loss in Pressure

4. CONCLUSION

This research studied the cause of excessive TEG loss in Imo River AGG Plant. The simulation was done using operating data from the plant. The material and energy balance of the plant was done using the principles of conservation of mass and energy. The plant sizing of the major equipment such as absorber (contactor), regenerator (distillation column) and heat exchanger were calculated. The diameter and height of the contactor was computed as 0.6096m and 6.034m respectively while the diameter and height of the regenerator was computed as 0.193m and 1.789m respectively and compared with base case specifications.
The major causes of TEG loss identified in this plant are:

(i) Operating at a high pressure of 78 bar (7800kpa) which should be reduced to 3202kpa to curb the effect of excessive TEG loss.
(ii) Operating at a temperature of 42^{o}C which should be kept at an optimum value of 35^{o}C to reduce TEG losses.
(iii) Using high TEG circulation rate of 24.57 m^3/hr which leads to accumulation of TEG in the contactor thereby causing loss of TEG, this should be reduced to about 15 m^3/h.

Sensitivity analysis was also carried out at it was absorbed that temperature was decreasing as pressure was constant throughout all the no of trays density and molecular weight decreased also along the trays and finally mole fraction of the food reduced along the trays.
Finally, operating pressure and temperature ranges that are close to the optimum temperature and pressure that gives the lowest FEG loss was recommended to be used as new operating conditions of the plant to minimize TEG losses. The new operating temperature range should be (30-32)^{o}C and new operating pressure range should be (3200-6000) Kpa.

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