Pressure to Gas Production Conversion

Calculation of Gas Volume in ml at 39°C with pressure measured in psi

The gas produced during the fermentation process results in an increase in pressure measured in psi. This gas pressure, measured over the chosen interval, can be converted to ml of gas produced using the following equation:

$$V_x = V_j P_{psi} \times 0.068004084$$

Where: V_x = gas volume at 39°C in ml
V_j = headspace of digestion jar (Glass Bottle) in ml
P_{psi} = cumulative pressure recorded by Gas Monitor System software

Furthermore, gas produced per 100 mg of substrate can be expressed by the following equation:

ml per 100mg = ml gas / (mg of substrate/100)

Derivation of the Gas Volume Equation

Convert gas pressure to moles of gas using the "Ideal Gas Equation" below:

$$n = Vp / RT$$

Where: n = quantity of gas in moles
P = pressure in kPa
V = volume gas occupied in L
T = temperature in Kelvin (K)
R = gas constant (8.314472 $L \cdot kPa \cdot K^{-1} \cdot mol^{-1}$)

Using Avogadro's Law, 1 mole will occupy 25.6 L at 39°C (312 Kelvin) with pressure measured in psi (1 psi = 6.894757293 kilopascal). Therefore, gas measured in moles can be converted to gas measured in ml as follows:

$$V_x / 25.6 = V_j P_{psi} \times 6.894757293 / 8.314472 \times 312$$
$$V_x = V_j P_{psi} \times 6.894757293 / 8.314472 \times 312 \times 25.6$$
$$V_x = V_j P_{psi} \times 0.068004084$$

Solving for V_x will give you the total ml of gas produced for the interval chosen.