**Title:** Investigations on the Corona Induced Degradation of Polymeric Insulating Samples  
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**Abstract**  
Insulators play an important role in the reliability and safe operation of EHV/UHV transmission lines. Recently several utilities in the country and elsewhere are using polymeric insulators for the high voltage transmission and distribution systems due to their advantages. Since, polymeric insulators are of recent origin and organic in nature, their long-term field performance is not yet fully understood. International standard organizations like CIGRE, IEC, IEEE etc., are currently working towards the development of methods for long term performance; some include resistance to corona, ozone, chemical attack, hydrophobicity etc., for the polymeric insulating samples. The present investigation focuses on two important aspects:  
(1) Investigations on the corona induced degradation on different polymeric samples under normal and due to different fog conditions.  
(2) Application of digital imaging techniques for the detection of corona discharges and its analysis.  

An experimental facility along with a new methodology is proposed and adopted for the corona induced degradation studies on polymer insulators samples. The investigations are conducted on different polymer samples for the normal and the effect of different fog environments, some interesting results are obtained, further the treated samples are analyzed using physico-chemical analysis, it was found that corona treated samples present higher hydroxylation, detection of nitric acid on sample surface which cause brittle fracture of fiberglass rod of the insulator, loss of Alumina trihydrate (ATH) filler, decrease in tensile strength on the insulator samples. It was observed from experimental investigations that corona activity is one of the important phenomena responsible for the degradation of polymeric insulators. Hence, periodic inspection of polymeric insulators and the detection of corona discharges are important in condition monitoring. Hence an attempt is made to analyze and quantify the coronadischarges using image processing techniques. A color threshold based corona plasma extraction algorithm is adopted. A luminance component ‘Y’ parameter is computed from the processed corona images and is shown to correlate well with the corona released power. A physical model is proposed to explain the phenomenon and is quantified by adopting the line-detection based image processing algorithm to compute the corona spread angle. It is observed that material degradation caused by the corona with less spread angle is higher in comparison to the wide spread corona. To overcome the limitation of conventional images, high dynamic range imaging technique is employed to accurately identify the location of corona stress on the polymeric samples. Interestingly, it is observed that the correlation between the degradation patterns estimated by the corona images and Fourier transform infrared spectroscopy (FTIR) show that HDR image provides the true correlation, whereas the conventional images resulted in pseudo-correlation.