AbstractID: 3974 Title: New Polymer Gel Dosimeter with High Refractive Index for Artifact-Free Optical CT Scanning

Purpose: In order to enable optical CT scanning of gels with inserts representing tissue heterogeneities such as bone or air spaces as well as brachytherapy catheters and applicators, as well as to remove artifacts which arise when scanning across regions adjacent to container walls, we have explored the feasibility of developing a new polymer gel that would result in matching the refractive index of the gel to that of the container material.

Method and Material: We have developed a new type of polymer gel dosimeter (and named it BANG4), based on cellulose acetate (gelling agent) in benzyl alcohol. The monomer we used in this study was methacrylic acid, which precipitates in benzyl alcohol upon polymerization. The gel is made under nitrogen atmosphere. These gels are optically clear and mechanically strong. Benzyl alcohol has the refractive index of 1.538 and methacrylic acid 1.429. Therefore, we can adjust the refractive index of the gel to match the material of the container (phantom) or insert, be it Lucite, PVC, PETG, Barex or glass. We have tested the dose response of the new gel using Torrex 150D X ray machine (EG&G, Long Beach, CA) and a spectrophotometer. We also scanned irradiated BANG4 gels in Barex and Lucite containers, using commercial OCTOPUS™ optical CT scanner (MGS Research, Madison, CT).

Results: We found the dose response of the new gel to be linear up to 6 Gy. The optical CT images of BANG4 gels reveal that the refractive artifact was entirely removed, as can be seen from image profiles.

Conclusions: We have successfully demonstrated the feasibility of a new class of polymer gels that can be OCT-scanned without the refractive artifact. Further studies are planned to investigate radiological properties of the new dosimeter.

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