6.1 Overall Conclusions

This section deals with the overall conclusions of the present study. This is followed by a brief discussion of applications and future projections of the present study.

1. The irradiation of PLGA with heavy ions degrade the polymer to great extent as porosity of the samples increased with increasing fluence and presence of microcavities in irradiated samples vs. smooth morphology in blank samples manifest degradation of PLGA.

2. The extent of dispersion of the clay plays a very important role in morphology of the resultant polymer nanocomposite. Clay agglomerations have not been observed when clay was dispersed in polymer matrix, after exposure of SHI. Presence of nanoclay is also found to enhance the properties of this degradable copolymer by reducing the rate of degradation even at high irradiation fluence.

3. The reduction in indirect optical band gap of PLGA samples after being subjected to swift heavy ion having high LET with increasing ion fluence, is associated with ion induced defects and disordering in PLGA.

4. Overall decrease in FTIR peaks intensity in ion irradiated samples at high fluence exhibit the breakage of bonds in ladder structure and leads to significant degradation of polymer.

5. A small increase in XRD peak intensity is found in high fluence Li^{3+} ion irradiated samples which suggest slight increase in crystallinity of PLGA.

6. Surface and structural properties of Ag^{8+} ion irradiated samples shows that the presence of hydroxyl groups (–OH) in nanoclay leads to hydrogen bonding interactions between the nanoclay and the polymer matrix. Also the shifting of d_{001} diffraction peak to a lower value of 2θ for nanocomposites at high fluence corresponds to the increased interlayer spacing in the polymer/clay matrices thereby demonstrating the intercalated nature of the nanocomposites.

7. The morphology of Li^{3+} ion irradiated nanocomposites reveals better nano dispersion of clay layers. Whereas an appearance of some tactoids as a result of Ag^{8+} ion irradiation suggests some degree of aggregation of nanoclay.
8. It was observed that neat PLGA degraded to greater extent by gamma irradiation while PLGA/Clay nanocomposites were comparatively less affected. The morphological defects after gamma radiation are more pronounced in PLGA samples as compared to the PLGA/Clay nanocomposite samples. Nano dispersion of clay layers in polymer matrix is aided and achieved by gamma radiation and exhibits exfoliated morphology which has important implications for drug delivery, biomedical applications and structural applications.

6.2 Applications

The present study will go a long way to predict the extent of damage or degradation which may occur in PLGA products being sterilized by radiation before their incorporation into the human body.

It is interesting to note that even the deliberately degraded PLGA with microcavities may also find useful applications. Two potential applications of degraded PLGA products in which substantial micro cavities have been formed in a controlled manner are:

1. Using them as a drug carrier agent, in which a drug can be loaded easily into the PLGA microcavities and later released inside a human body, when the porous structure dissolves readily and at a tunable rate in the body.

2. Using it as a porous scaffold.

6.3 Future Perspectives

1. Gel permeation chromatography (GPC), technique can be used to determining the molecular weight distribution of PLGA at different stages of its degradation.

2. The structural and morphological properties of PLGA/Cloisite 30B nanocomposite can be compared with other nanocomposites such as Cloisite Na⁺, Cloisite 20A, Cloisite 15 A, Cloisite 25A and same clay (Cloisite 30B) with different composition such as (7wt%, 10 wt%) to study the extent of intercalation.
3. Techniques such as TGA, DSC and TEM can be used to study the detailed mechanism of the weight loss and nanoscale dispersion of nanoclay in the matrix polymer.

4. Swift heavy ion irradiated PLGA and PLGA nanocomposites film samples can be used as templates for preparation of nanowires and nanotubes.