General information	
PPP number	**TKI-AF-**16037
Title	*HIPUDA*
Roadmap/Umbrella	**Kernthema Circulair**
Executive knowledge institution(s)	**Wageningen food and biobased research**
Research project leader (name + e-mail address)	**Rutger Knoop** **Rutger.knoop@wur.nl**
Coordinator (on behalf of private parties)	**Maarten van der Zee**
Government contact person	
Start date	**01-01-2017**
End date	**31-12-2018**

Approval coordinator/consortium	
The coordinator has assessed the annual report on behalf of the consortium:	x approved □ rejected
Possible feedback on the annual report:	

Short content description/aim PPS
In this project, the goal is to increase the toughness of PLA with dimer fatty acids from vegetable oils or derivatives thereof. The aim is to develop a high impact food contact proof injection moulding PLA grades with a biobased content higher than 90% (w/w). The approach to achieve this goal is called dynamic vulcanization. A dimer fatty acid derivative (supplied by Croda) is added into a polylactic acid (supplied by Synbra) melt in an extruder and the dimer fatty acid derivative is cross linked subsequently. This will result in PLA with rubber like particles (cross linked dimer fatty acid derivative). The ratio dimer fatty acid: PLA will be varied and the mechanical properties, tensile strength, notched and unnotched impact resistance and falling dart will be determined.

Planning and progress	
Is the PPP going according to plan?[1]	This PPP goes sticktly according plan
Have there been changes in the consortium/project partners?	There have been no changes in the consortium partners
Is there a delay and/or deferred delivery date?	There is no delay
Are there any substantive bottlenecks? Provide a brief description	There are no substantive bottlenecks
Are there any deviations from the projected budget?	There are no deviations from the project plan
Do you expect a patent application to arise from this	The process itself is already patented but when this project is successful, the process and the material will be commercialized

[1] If applicable, use the explanation from the financial project report

PPP?	

Current summary of the project for the website Kennisonline
In this project, the goal is to increase the toughness of PLA with dimer fatty acids from vegetable oils or derivatives thereof. The aim is to develop a high impact food contact proof injection moulding PLA grades with a biobased content higher than 90% (w/w). This scientific challenge is both from industrial and societal point of view interesting because it can significantly widen the application areas of PLA; one of the best prized biobased and biodegradable plastics currently on the market. From the perspective of the agri-food industry the benefits are twofold. From the supply side point of view this development can lead to new added value applications of natural oil derivatives and increase the use of PLA made from fermentable sugar sources like corn and sugar beet. From a demand side perspective this development can open up the market for PLA for B2B and B2C food packaging in applications now dominated by petrochemical polymers like HIPS, PP and HDPE. From scientific point of view, reduction of the particle size by this technology is highly challenging. Reduction of the particle size will be of main importance and for that, a detailed study of the extruder design in incorporated in this project.

Highlights:
Three trails have been performed in 2017. In the first trial, the dynamic vulcanisation was performed in two separate steps, in the first step, the dimer fatty acid derivative (DFAD) was mixed with four different grades of PLA in the extruder. Two DFADs were mixed in ratios from 5 to 15% (w/w). In a subsequent step, after drying the DFAD -PLA blend a cross link reaction was performed on the extruder. It was proven that this methods works for all PLA grades. The higher the DFAD content, the lower the tensile strength but the elongation at break significantly increased. The notched and the unnotched increased with increasing DFAD content and ultimately, materials which could not break at our setup were obtained. The falling dart impact resistance also significantly improved. These results were independent on the DFAD and PLA grade. In the second trial, only two PLA grades were used and two DFADs, one as reference to compare the results with previous trial and a less expansive DFAD. First the two step approach, as in the previous trial was tested. In the third trial, the mixing of the DFAD with PLA and the cross linking were executed in one single run. The results from the last trial were compared with the results of the second trial. Although similar trend as in the first trial were observed, the third trial needs further optimization. This is planned for the trials in 2018.

Number of delivered products in 2016			
Academic articles	Reports	Articles in journals	Introductions/workshops
none	None	None	none

Appendix: Names of the products or a link to the products on a public website

https://www.wur.nl/en/Research-Results/kennisonline/HIPUDA.htm
http://topsectoragrifood.nl/project/high-impact-pla-using-dimer-fatty-acids/

Akkoord: Hans van der Kolk (Topsectorsecretaris)