REPLACING MCCPS WITH SANTICIZER® PHOSPHATE ESTERS

Reformulating flame-retardant formulations is considerably more complicated than many other reformulations. This is because flame retardant additives vary in a number of important ways. Some are solids and some are liquids. Some have plasticizing ability and others do not. They can vary in chemistry and their mode of flame action. These differences are important considerations when planning your reformulation strategy.

In this example, we will demonstrate two possibilities for replacing a Medium-Chain Chlorinated Paraffin (MCCP) with Santicizer® Phosphate ester plasticizers. MCCPs and Santicizer® Phosphate esters are both plasticizers and flame retardants, though they differ in their efficacy for each. When replacing MCCPs, it will be important to assess hardness and all relevant mechanical properties, as well as fire and smoke properties, to ensure the performance is not degraded.

In the examples below, the MCCP was replaced at slightly less than a 1:1 ratio to accommodate for the Santicizer® Phosphate esters' higher plasticizing efficiency, and serves as a good starting point for evaluation. The MCCP was 50% Chlorine by weight.

The impact of the changes are shown in the tables below. Removing the MCCP decreases the fire-retardant properties and increases the hardness. The addition of the Santicizer® Phosphate esters restores the hardness and flame retardancy. The results of these reformulations are shown on the next page.

Example 1: Replacement with Santicizer® 141 (by PHR)

	MCCP	S141	Δ
MCCP	20		-20
Santicizer® 141		15	15
PVC Resin	100	100	
DIDP	50	50	
Stabilizer	1	1	
$CaCO_3$	40	40	

Change	Fire	Physical
MCCP ↓	-	-
Santicizer® 141 ↑	+	+

Example 2: Replacement with Santicizer® 154 (by PHR)

	MCCP	S154	Δ
MCCP	20		-20
Santicizer® 154		15	15
PVC Resin	100	100	
DIDP	50	50	
Stabilizer	1	1	
$CaCO_3$	40	40	

Change	Fire	Physical
MCCP ↓	-	-
Santicizer® 154 ↑	+	+

VALTRIS SPECIALTY CHEMICALS
7500 E. Pleasant Valley Rd.
Independence, Ohio 44131 Phone (216) 875-7200
Fax (216) 875-7201
10/09/2024

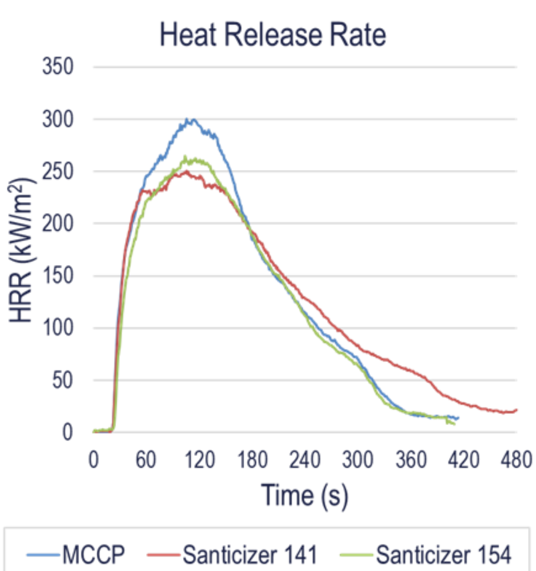
Development Test Results

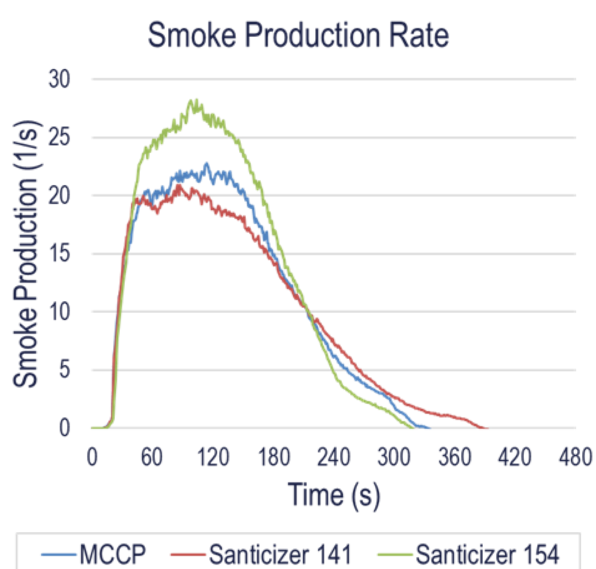
	MCCP	Santicizer® 141	Santicizer® 154
Hardness, Shore A	64	62	63
Force at Break (lbf)	4.84	4.97	4.85
Tensile Strain (%)	291.0	291.5	301.7
Max. Tensile Stress (psi)	1790.2	1677.5	1839.4
Limiting Oxygen Index (%)	17.8	18.3	18.7

As you can see, the initial results indicate that physical, mechanical, and fire retardance properties have been retained. To get a better look at the flame and smoke performance, cone calorimetry can be used to provide more information about how the replacement affects the fire and smoke properties of the sample.

Cone Calorimetry Results

	MCCP	Santicizer® 141	Santicizer® 154
Fire Growth Rate (kW/s)	4.95	5.03	4.21
Peak Heat Release Rate (kW/m^2)	303.5	253.3	266.8
Total Heat Release (MJ/m^2)	55.8	58.2	51
Maximum Average Rate of Heat Emission (kW/m^2)	215.5	192.1	191.1
Total Smoke Production (m^2/m^2)	3958	3895	4436
Average Specific Extinction Area (m^2/kg)	1178	1162	1342





The results of the cone calorimetry show the differences in performance between the MCCP, Santicizer® 141, and Santicizer® 154. We can see that Santicizer® 141 and Santicizer® 154 both offer improvements in fire retardance compared to the MCCP, but differences in fire growth rates and smoke generation requirements

VALTRIS SPECIALTY CHEMICALS
7500 E. Pleasant Valley Rd.
Independence, Ohio 44131 Phone
(216) 875-7200
Fax (216) 875-7201
10/09/2024

should be taken into consideration to meet an individual formulator's needs. This is because chemical differences between Santicizer® 141 and Santicizer® 154 lend themselves to different performance. Santicizer® 154 provides better flame inhibition whereas Santicizer® 141 generates less smoke.

Technical Service Contact:
Coilin Richards
coilin.richards@valtris.com

Customer Service & TDS Requests
For more information about our plasticizers visit our plasticizer portal.

Valtris Overview

Valtris is a global leader in specialty chemical additives and precursors, offering innovative solutions and products to customers around the world. With strong technical expertise and best-in-class formulation capabilities, we develop products that provide essential performance properties to plastics, coatings, adhesives and sealants, pharmaceuticals, flavor and fragrance, and personal care products. For more than 75 years, we have served as a trusted partner for customers by providing exceptional service and high-quality products. www.valtris.com