Studi Penambahan Microcrystalline Cellulose dan Microfibrillated Cellulose sebagai Nucleating Agent pada Proses Kristalisasi Polimer Polipropilena = Study of Addition of Microcrystalline Cellulose and Microfibrillated Cellulose as Nucleating Agent in Polypropylene Polymer Crystallization Process

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Abstrak

Polipropilena (PP) adalah polimer termoplastik yang digunakan dalam berbagai aplikasi. Proses kristalisasi adalah proses yang memiliki peranan penting dalam produksi PP. Penambahan nucleating agent yang berfungsi mempersingkat waktu induksi kristalisasi polimer tertentu, termasuk PP. Tujuan dari penelitian ini untuk menganalisis pengaruh penambahan microcrystalline cellulose (MCC) dan microfibrillated cellulose (MFC) sebagai aditif nucleating agent pada proses kristalisasi PP dan memperoleh persentase optimum yang dibandingkan terhadap Hyperform HPN-20E (HPN) sebagai nucleating agent komersial dan PP murni. MFC dibuat dengan alkalisasi, bleaching dan hidrolisis. MFC dan MCC dikarakterisasi dengan SEM dan XRD. Masing-masing dari MFC, MCC dan HPN dilakukan internal mixing dengan PP pwd dengan konsentrasi 0,10; 0,20; 0,40; 1,00 dan 2,00 phr untuk selanjutnya diwakili dengan penomoran 1, 2, 3, 4 dan 5 dan PP pwd untuk blangko. Sampel masterbatch MFC, MCC, HPN dan PP dilakukan karakterisasi dengan uji FTIR, XRD, DSC dan Tarik. Hasilnya menunjukkan bahwa MCC dan MFC dapat meningkat derajat kristalinitas, suhu leleh, suhu kristalisasi dan kekuatan tarik polimer PP walaupun belum menyamai kinerja dari HPN. Persentase optimum masterbatch PP+MFC5 dan PP+MCC4 dengan peningkatan derajat kristalinitas masing-masing sebesar 19,96% dan 18,24% terhadap PP murni. Namun, belum dapat menyamai kinerja HPN pada kondisi optimum masterbatch PP+HPN5 dengan peningkatan derajat kristalinitas sebesar 54,80%. Persentase optimum masterbatch PP+MFC5 dan PP+MCC5 pada peningkatan suhu leleh masing-masing sebesar 2,8°C dan 3,3°C terhadap PP murni. Namun, belum dapat menyamai kinerja HPN pada kondisi optimum masterbatch PP+HPN2 dan masterbatch PP+HPN3 dengan peningkatan suhu leleh yang sama yaitu sebesar 4,4°C. Persentase optimum masterbatch PP+MFC4, PP+MFC5 dan PP+MCC5 pada peningkatan suhu kristalisasi masing-masing sebesar 5,0°C, 5,0°C dan 5,7°C terhadap PP murni. Namun, belum dapat menyamai kinerja HPN pada kondisi optimum masterbatch PP+HPN5 dengan peningkatan suhu kristalisasi sebesar 19,0°C.

.....Polypropylene (PP) is a thermoplastic polymer used in a variety of applications. Crystallization process is a process that has an important role in PP production. The addition of a nucleating agent that serves to shorten the crystallization induction time of certain polymers, including PP. The purpose of this study was to analyze the effect of adding microcrystalline cellulose (MCC) and microfibrillated cellulose (MFC) as nucleating agent additives to the PP crystallization process and to obtain the optimum percentage compared to Hyperform HPN-20E (HPN) as commercial nucleating agent and Pure PP. MFC is made by alkalization, bleaching and hydrolysis. MFC and MCC were characterized by SEM and XRD. Each of the MFC, MCC and HPN were internally mixed with PP pwd with a concentration of 0.10; 0.20; 0.40; 1.00 and 2.00 phr are then represented by numbering 1, 2, 3, 4 and 5 and PP pwd for blanks. The MFC, MCC, HPN and PP masterbatch samples were characterized by FTIR, XRD, DSC and Tensile tests. The results show that MCC

and MFC can increase the degree of crystallinity, melting temperature, crystallization temperature and tensile strength of PP polymer although they cannot match the performance of HPN. The optimum percentages of PP+MFC5 and PP+MCC4 masterbatches with increasing degree of crystallinity were 19.96% and 18.24%, respectively, compared to pure PP. However, it has not been able to match the performance of HPN under the optimum conditions of the PP+HPN5 masterbatch with an increase in the degree of crystallinity of 54.80%. The optimum percentages of PP+MFC5 and PP+MCC5 masterbatches at increasing melting temperatures were 2.8°C and 3.3°C, respectively, for pure PP. However, it has not been able to match the performance of HPN under the optimum conditions of the PP+HPN2 masterbatch and PP+HPN3 masterbatch with the same increase in melting temperature of 4.4°C. The optimum percentages of PP+MFC4, PP+MFC5 and PP+MCC5 masterbatches at increasing crystallization temperature were 5.0°C, 5.0°C and 5.7°C for pure PP, respectively. However, it has not been able to match the performance of HPN under the optimum conditions of the PP+HPN5 masterbatch with an increase in crystallization temperature of 19.0°C.