Due to its backward compatibility, multi-threaded programming in Java is often performed ineffectively and repels inexperienced programmers from development of parallel applications. This thesis introduces omp4j - an OpenMP-like preprocessor that supports Java language standards 6, 7 and 8 without any runtime dependencies. Furthermore, the thesis develops a scalable and portable solution for all commonly used JDKs. The combination of the syntax and bytecode analyses is employed by the preprocessor in order to parallelize the source code. The developed project may be used either as a CLI utility or as a third-party library for Java and Scala projects. The latter possibility is demonstrated in an online demo which was developed together with the project website - www.omp4j.org. Additionally, the performance evaluation, which discusses various aspects of the implemented preprocessor, is presented and the comparisons to the related C++ and Java solutions are elaborated. In comparison to the similar projects, significantly better scalability of omp4j is proven at significance level alpha = 0.01 for some of the benchmarks.